

FOOD THE REAL PALEO DIET

SEPTEMBER 2014

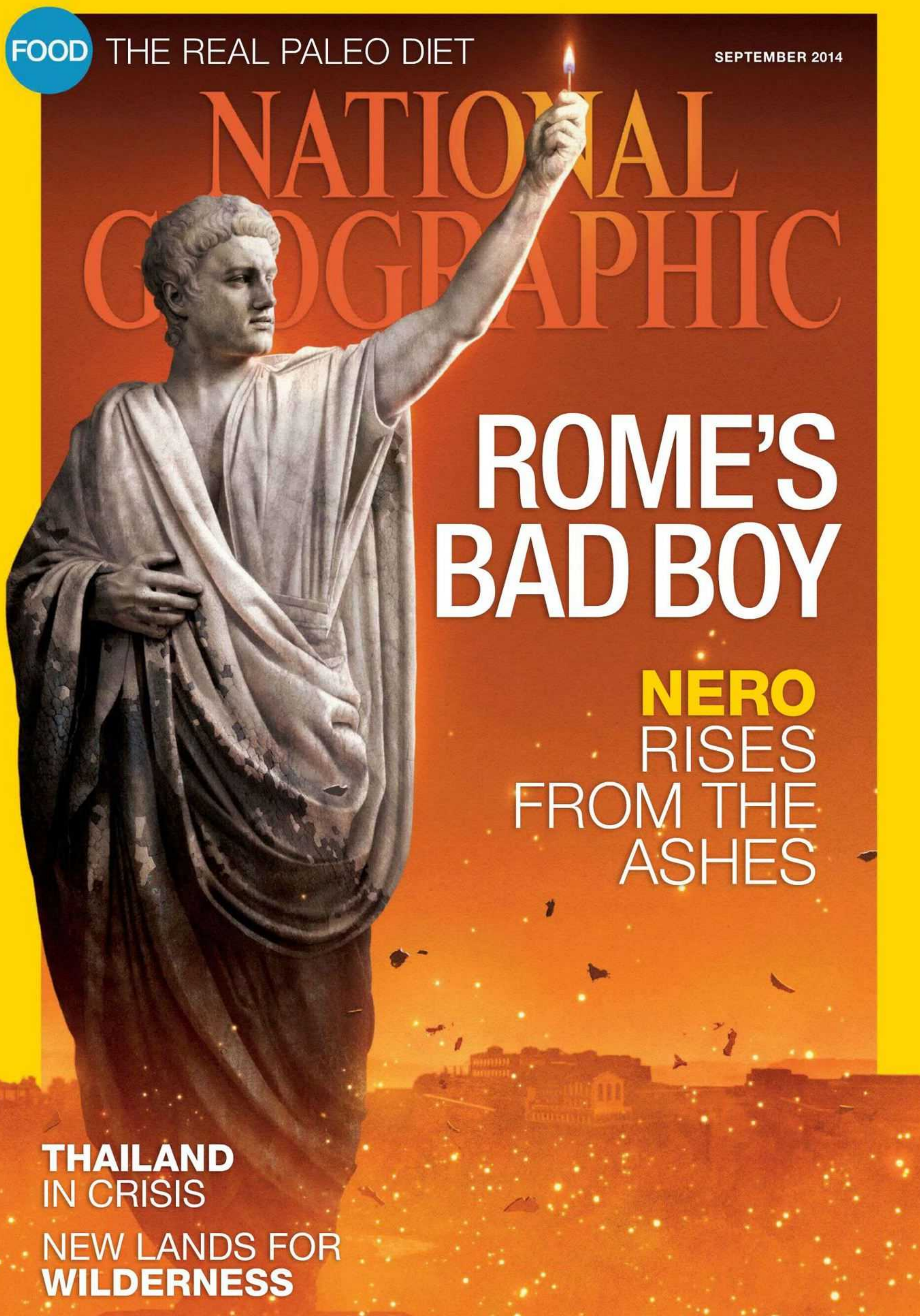
# NATIONAL GEOGRAPHIC

## ROME'S BAD BOY

**NERO**  
RISES  
FROM THE  
ASHES

**THAILAND**  
IN CRISIS

NEW LANDS FOR  
**WILDERNESS**







**White Cay Rock Iguana** (*Cyclura rileyi cristata*)

**Size:** Body length, 10.2 - 28 cm (4 - 11 inches); tail, 7.1 - 54.3 cm (2.8 - 21.4 inches)

**Weight:** Females average 474 g (16.7 oz), males average 683 g (24.1 oz) **Habitat:** Occurs only on the island of White (Sandy) Cay in the southern Exuma archipelago of the Bahamas **Surviving number:** Estimated at 1,500



Photographed by Roy Toft

# WILDLIFE AS CANON SEES IT

It only takes one. The natural balance achieved by the White Cay rock iguana over some 7,000 years of isolated development was nearly destroyed by the appearance of a single raccoon on the island. Before its own death, the voracious invader decimated the population. When left in peace, the iguana spends its time feeding on land plants, conserving water by excreting excess

sodium and potassium via salt glands. With its one raccoon archenemy gone and rats removed from the island, the endemic iguana now has a chance to recover and live on.

As Canon sees it, images have the power to raise awareness of the threats facing endangered species and the natural environment, helping us make the world a better place.



EOS System







Off the coast of Malaysia a Bajau man leans from a boat to fish, as his people have done for centuries. Story on page 30.

MATTHIEU PALEY

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Would eating like our Stone Age ancestors really be healthier for us—and the planet?  
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Now the southern Line Islands will be protected.  
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**Surf's Down, Mate!**

Off the east coast of Australia, the size of waves is dropping.

FOOD

**Please Pass the Bugs**

More than one-fourth of the global population eats insects.

**Suited for Space**

Future astronauts may trade bulky suits for "shrink-wrap" garments.

**The Best-Read Towns**

Where does your hometown rank among literate U.S. cities?

**Reading the Wag-Ometer**

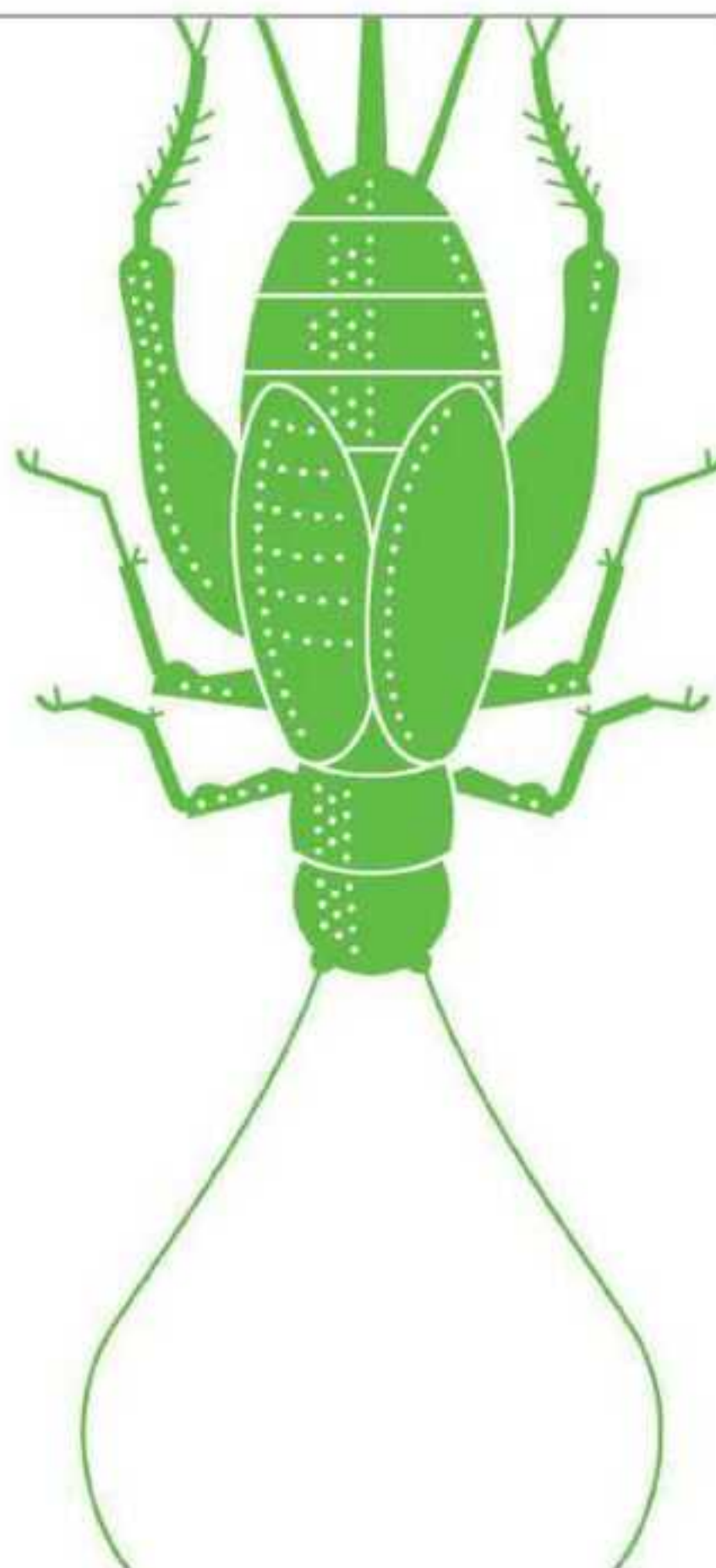
A dog's tail tells the tale about canine emotions.

**Plenty of Cold Words**

Dialects of Alaskan Inupiaq have many ways to describe sea ice.

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Minor league baseball covers the bases for colorful team names.



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**Our Evolving Diet**  
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**On the Cover** The emperor Nero was in fact "no worse than those who came before and after him," says journalist Marisa Ranieri Panetta. Yet throughout history he has been depicted as a depraved murderer who let Rome burn in A.D. 64. *Artist's rendering of Nero by Sam Weber*

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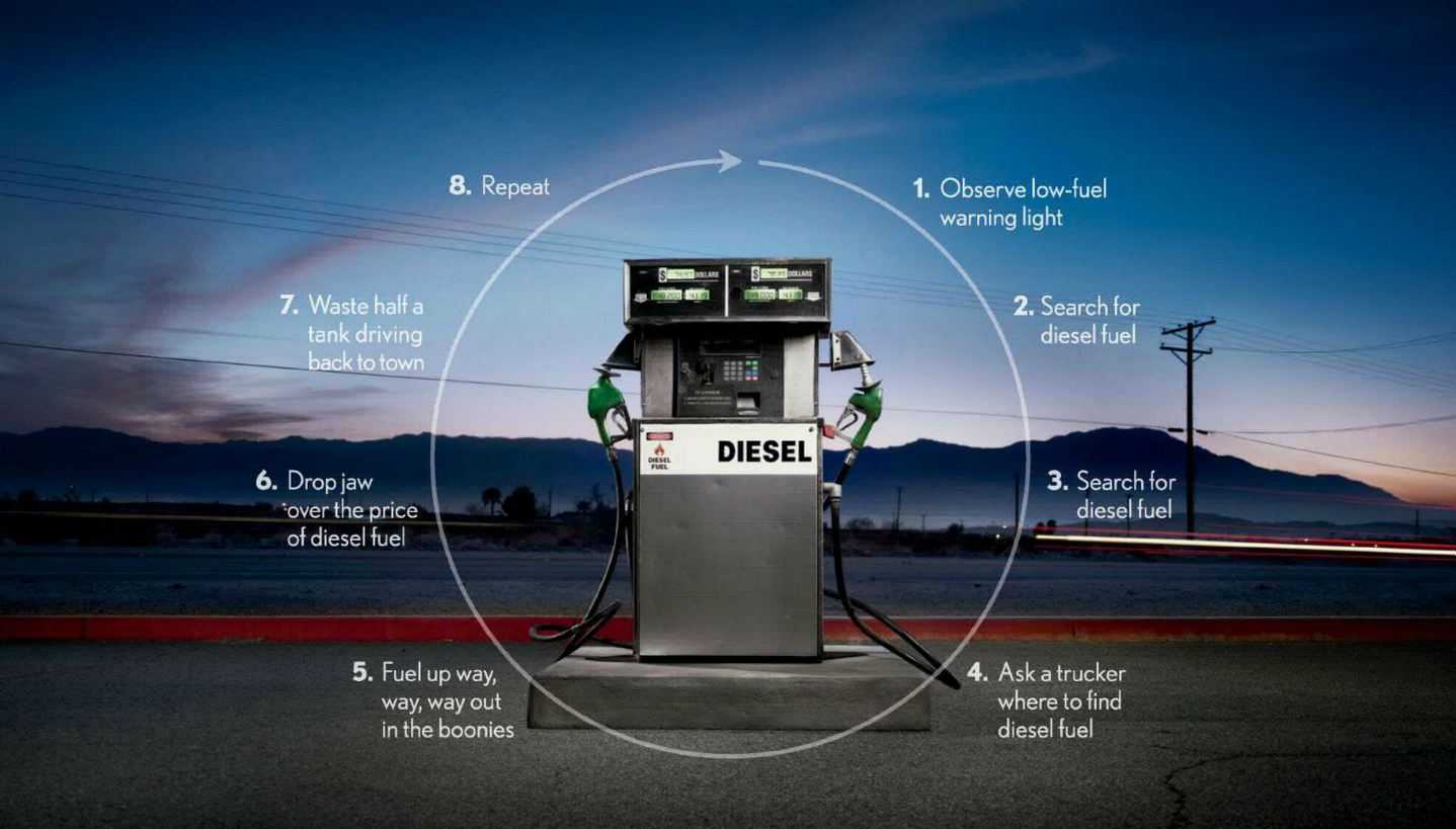
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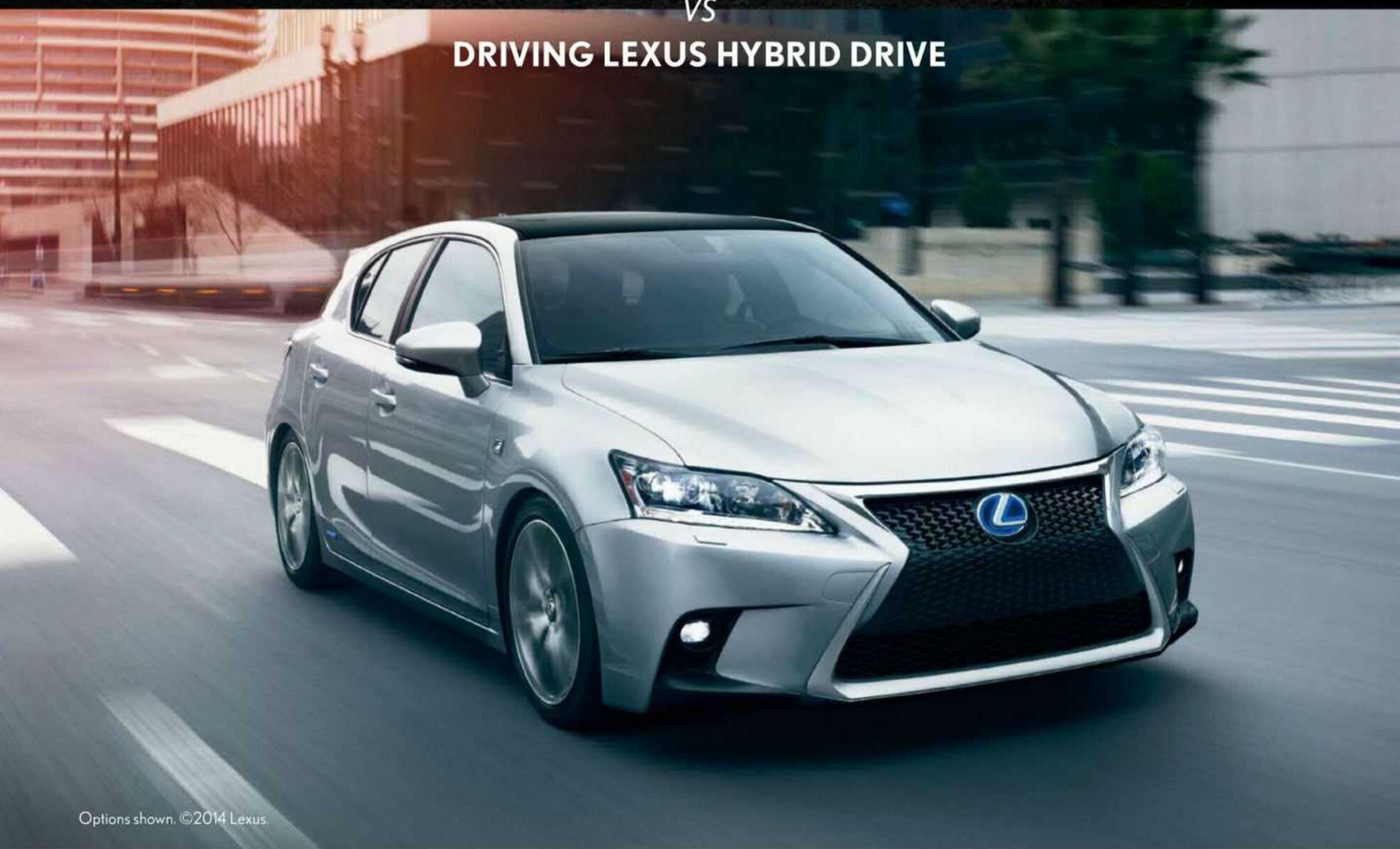
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## In Search of Pristine Seas

It was 2004, and Enric Sala, then an associate professor at Scripps Institution of Oceanography, felt as if he was “writing the obituary of the ocean.” Sala spent his days documenting the decline of over-fished, polluted seas, trying to understand why coral reefs were dying and large predators were disappearing. “I felt like a doctor who was providing a description of how the patient was going to die, in excruciating detail, but not providing a solution,” he says.



Enric Sala dives with a green turtle during a Pristine Seas expedition off Cocos Island, Costa Rica.

It was frustrating—and unacceptable. So Sala founded the Pristine Seas project to explore and protect the planet's last wild marine sites.

Sala, a National Geographic explorer-in-residence, has headed ten expeditions, ranging from Franz Josef Land in the Russian Arctic (featured in our August issue) to the waters off New Caledonia in the South Pacific. In Pristine Seas' five-year existence, a total area about the size of Montana—some 150,000 square miles—has been protected.

Now Kiribati's government has declared a 12-nautical-mile fishing exclusion zone around each of the southern Line Islands, five tiny specks of land about 2,000 miles south of Hawaii. On the surface these uninhabited islands appear ordinary. Beneath, photographer Brian Skerry documents in this issue, is an underwater paradise. “It looks like a coral reef of a thousand years ago,” Sala says.

The work of Pristine Seas continues. Sala expects several more areas to be named as sanctuaries, and in June President Obama announced plans to create the world's largest ocean preserve, in the central Pacific. Perhaps author Rachel Carson best explained the urgency that informs the mission of saving our seas: “The more clearly we can focus our attention on the wonders and realities of the universe about us, the less taste we shall have for... destruction.”

Susan Goldberg, *Editor in Chief*





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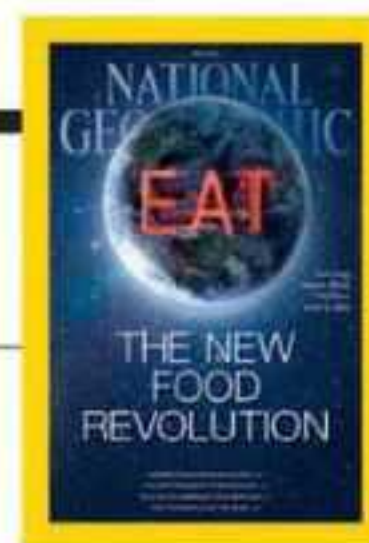
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## Feeding Nine Billion

I appreciate author Jonathan Foley's focus on how we will be able to feed the nine billion on our planet by mid-century. One problem I see: More than three million children under age five die every year from nutrition-related causes. Millions more grow up with physical problems due to lack of proper nutrition.

- ▶ If we can't stop these problems today, how can we take care of two billion more people in the future? One thing citizens can do is to write or call their elected leaders and bring this problem to their attention. There is enough food. How can we make sure everyone gets enough to survive?

**WILLIE DICKERSON**  
Snohomish, Washington

In step four of Foley's recommendations for doubling the world's supply of food, he suggests shifting diets away from livestock because they are an inefficient use of the calories created in growing the grain used to feed them. But he missed mentioning the widespread agriculture used to grow crops that yield virtually zero calories. There's nowhere in the world that I haven't witnessed massive consumption of coffee, tea, and tobacco. If we must

shift our diets away from foods that yield well under the optimal calories producible per acre, then shouldn't we first shift our consumption away from products that produce so few calories per acre?

**ALAN GEIST**  
Portland, Oregon

Conventional farming implies that it is an acceptable standard. If our demand for quick food continues, I fear the corporations of the world will

hijack the food security agenda to reinforce the need for more megafarming and manipulation of the abundance Earth has provided us with for thousands of years. I fear the next generation can look forward only to a manipulated food chain grown inside, and we will reminisce of the days when we grew multiple varieties outside and animals knew what daylight was.

**MEGAN ARNOLD**  
Twickenham, England

My grandfather was a farmer his entire life. Like the earth he worked, he was generous to his family and community. I see him reflected in each of the beautiful portraits of the farmers around the world in your article. They tell a story of hope and survival.

**LUIS A. MORALES**  
Washington, D.C.

### Corrections

MAY 2014, THE GENEROUS GULF On the map of the Gulf of St. Lawrence (pages 106-107), Bonne Bay is incorrectly labeled. The correct name is Bay of Islands.

NEXT: À LA CARTE The record for the heaviest potato is actually ten pounds, 14 ounces.

**FEEDBACK** Readers shared their memories of Paris.

*"Walking along the river was always a special treat."*

*"We eventually had walked almost the entire Paris bank on both sides."*

*"I felt nostalgic for the people who locked their love 'eternally' to the Pont des Arts."*

*"The story on the Seine made me fall in love with a winding river I've never even seen."*



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# VISIONS

An aerial photograph showing a dense forest of green trees on the left and a small, irregularly shaped lake on the right. The forest is a mix of vibrant green and some brownish, dead-looking trees. The lake is a deep blue color, and a dark shadow is visible in the water, likely from the photographer. The overall scene is a natural landscape in springtime.

## Poland

Tricity Landscape Park turns verdant in springtime. This image and the two that follow document the same spot in autumn and winter. To create these images, the photographer flew a powered paraglider over this tiny lake; that's his shadow in the water.

PHOTOS: KACPER KOWALSKI,  
PANOS PICTURES

















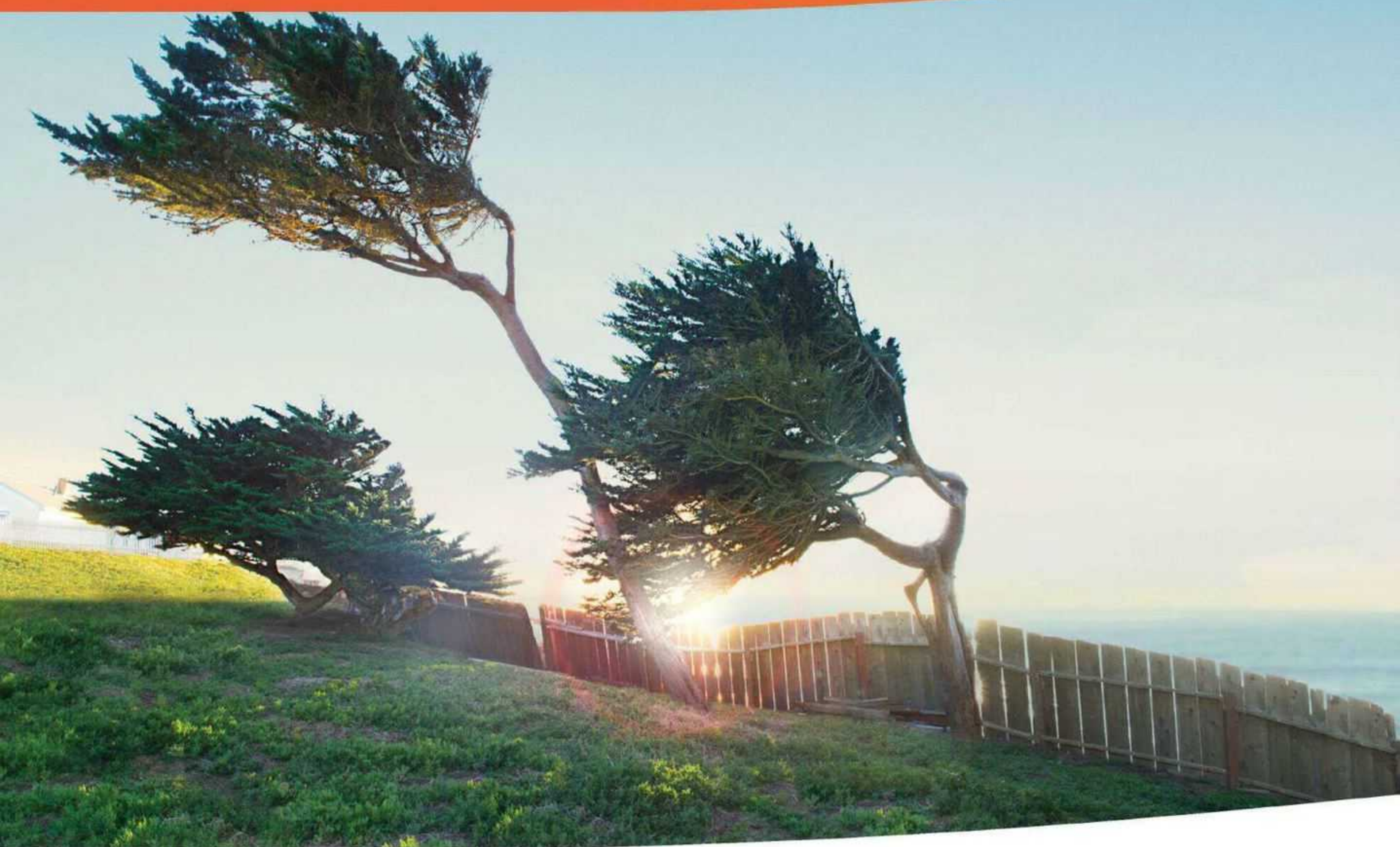
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## For people with a higher risk of stroke due to Atrial Fibrillation (AFib) not caused by a heart valve problem



ELIQUIS<sup>®</sup> (apixaban) is a prescription medicine used to reduce the risk of stroke and blood clots in people who have atrial fibrillation, a type of irregular heartbeat, not caused by a heart valve problem.

### **IMPORTANT SAFETY INFORMATION:**

- Do not stop taking ELIQUIS for atrial fibrillation without talking to the doctor who prescribed it for you. Stopping ELIQUIS increases your risk of having a stroke. ELIQUIS may need to be stopped, prior to surgery or a medical or dental procedure. Your doctor will tell you when you should stop taking ELIQUIS and when you may start taking it again. If you have to stop taking ELIQUIS, your doctor may prescribe another medicine to help prevent a blood clot from forming.
- ELIQUIS can cause bleeding, which can be serious, and rarely may lead to death.
- You may have a higher risk of bleeding if you take ELIQUIS and take other medicines that increase your risk of bleeding, such as aspirin, NSAIDs, warfarin (COUMADIN<sup>®</sup>), heparin, SSRIs or SNRIs, and other blood thinners. Tell your doctor about all medicines, vitamins and supplements you take. While taking ELIQUIS, you may bruise more easily and it may take longer than usual for any bleeding to stop.
- Get medical help right away if you have any of these signs or symptoms of bleeding:
  - unexpected bleeding, or bleeding that lasts a long time, such as unusual bleeding from the gums; nosebleeds that happen often, or menstrual or vaginal bleeding that is heavier than normal
  - bleeding that is severe or you cannot control
  - red, pink, or brown urine; red or black stools (looks like tar)
  - coughing up or vomiting blood or vomit that looks like coffee grounds
  - unexpected pain, swelling, or joint pain; headaches, feeling dizzy or weak
- ELIQUIS is not for patients with artificial heart valves.
- Spinal or epidural blood clots or bleeding (hematoma). People who take ELIQUIS, and have medicine injected into their spinal and epidural area, or have a spinal puncture have a risk of forming a blood clot that can cause long-term or permanent loss of the ability to move (paralysis).



# I focused on finding something better than warfarin.

## NOW I TAKE ELIQUIS® (apixaban) FOR 3 GOOD REASONS:

- 1 ELIQUIS reduced the risk of stroke better than warfarin.
- 2 ELIQUIS had less major bleeding than warfarin.
- 3 Unlike warfarin, there's no routine blood testing.

ELIQUIS and other blood thinners increase the risk of bleeding which can be serious, and rarely may lead to death.

## Ask your doctor if ELIQUIS is right for you.

This risk is higher if, an epidural catheter is placed in your back to give you certain medicine, you take NSAIDs or blood thinners, you have a history of difficult or repeated epidural or spinal punctures. Tell your doctor right away if you have tingling, numbness, or muscle weakness, especially in your legs and feet.

- **Before you take ELIQUIS**, tell your doctor if you have: kidney or liver problems, any other medical condition, or ever had bleeding problems. Tell your doctor if you are pregnant or breastfeeding, or plan to become pregnant or breastfeed.

- **Do not take ELIQUIS if you** currently have certain types of abnormal bleeding or have had a serious allergic reaction to ELIQUIS. A reaction to ELIQUIS can cause hives, rash, itching, and possibly trouble breathing. Get medical help right away if you have sudden chest pain or chest tightness, have sudden swelling of your face or tongue, have trouble breathing, wheezing, or feeling dizzy or faint.

*You are encouraged to report negative side effects of prescription drugs to the FDA. Visit [www.fda.gov/medwatch](http://www.fda.gov/medwatch), or call 1-800-FDA-1088.*

**Please see additional Important Product Information on the adjacent page.**

Individual results may vary.

**Visit [ELIQUIS.COM](http://ELIQUIS.COM) or call 1-855-ELIQUIS**

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432US14BR00451-02-01 04/14



**Eliquis**<sup>®</sup>  
(apixaban) tablets 5mg  
2.5mg



## IMPORTANT FACTS about ELIQUIS® (apixaban) tablets

**Rx ONLY**

The information below does not take the place of talking with your healthcare professional. Only your healthcare professional knows the specifics of your condition and how ELIQUIS may fit into your overall therapy. Talk to your healthcare professional if you have any questions about ELIQUIS (pronounced ELL eh kwiss).

### What is the most important information I should know about ELIQUIS (apixaban)?

**For people taking ELIQUIS for atrial fibrillation: Do not stop taking ELIQUIS without talking to the doctor who prescribed it for you. Stopping ELIQUIS increases your risk of having a stroke.** ELIQUIS may need to be stopped, prior to surgery or a medical or dental procedure. Your doctor will tell you when you should stop taking ELIQUIS and when you may start taking it again. If you have to stop taking ELIQUIS, your doctor may prescribe another medicine to help prevent a blood clot from forming.

**ELIQUIS can cause bleeding** which can be serious, and rarely may lead to death. This is because ELIQUIS is a blood thinner medicine that reduces blood clotting.

**You may have a higher risk of bleeding if you take ELIQUIS and** take other medicines that increase your risk of bleeding, such as aspirin, nonsteroidal anti-inflammatory drugs (called NSAIDs), warfarin (COUMADIN®), heparin, selective serotonin reuptake inhibitors (SSRIs) or serotonin norepinephrine reuptake inhibitors (SNRIs), and other medicines to help prevent or treat blood clots.

Tell your doctor if you take any of these medicines. Ask your doctor or pharmacist if you are not sure if your medicine is one listed above.

### While taking ELIQUIS:

- you may bruise more easily
- it may take longer than usual for any bleeding to stop

### Call your doctor or get medical help right away if you have any of these signs or symptoms of bleeding when taking ELIQUIS:

- unexpected bleeding, or bleeding that lasts a long time, such as:
  - unusual bleeding from the gums
  - nosebleeds that happen often
  - menstrual bleeding or vaginal bleeding that is heavier than normal

- bleeding that is severe or you cannot control
- red, pink, or brown urine
- red or black stools (looks like tar)
- cough up blood or blood clots
- vomit blood or your vomit looks like coffee grounds
- unexpected pain, swelling, or joint pain
- headaches, feeling dizzy or weak

### ELIQUIS (apixaban) is not for patients with artificial heart valves.

**Spinal or epidural blood clots or bleeding (hematoma).** People who take a blood thinner medicine (anticoagulant) like ELIQUIS, and have medicine injected into their spinal and epidural area, or have a spinal puncture have a risk of forming a blood clot that can cause long-term or permanent loss of the ability to move (paralysis). Your risk of developing a spinal or epidural blood clot is higher if:

- a thin tube called an epidural catheter is placed in your back to give you certain medicine
- you take NSAIDs or a medicine to prevent blood from clotting
- you have a history of difficult or repeated epidural or spinal punctures
- you have a history of problems with your spine or have had surgery on your spine

If you take ELIQUIS and receive spinal anesthesia or have a spinal puncture, your doctor should watch you closely for symptoms of spinal or epidural blood clots or bleeding. Tell your doctor right away if you have tingling, numbness, or muscle weakness, especially in your legs and feet.

### What is ELIQUIS?

ELIQUIS is a prescription medicine used to:

- reduce the risk of stroke and blood clots in people who have atrial fibrillation.

*(Continued)*



**Bristol-Myers Squibb**

**PATIENT ASSISTANCE FOUNDATION**

*This independent, non-profit organization provides assistance to qualifying patients with financial hardship who generally have no prescription insurance. Contact 1-800-736-0003 or visit [www.bmspaf.org](http://www.bmspaf.org) for more information.*



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## IMPORTANT FACTS about ELIQUIS® (apixaban) tablets *(Continued)*

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- reduce the risk of forming a blood clot in the legs and lungs of people who have just had hip or knee replacement surgery.

It is not known if ELIQUIS is safe and effective in children.

---

### Who should not take ELIQUIS (apixaban)?

#### Do not take ELIQUIS if you:

- currently have certain types of abnormal bleeding
- have had a serious allergic reaction to ELIQUIS. Ask your doctor if you are not sure

---

### What should I tell my doctor before taking ELIQUIS?

#### Before you take ELIQUIS, tell your doctor if you:

- have kidney or liver problems
- have any other medical condition
- have ever had bleeding problems
- are pregnant or plan to become pregnant. It is not known if ELIQUIS will harm your unborn baby
- are breastfeeding or plan to breastfeed. It is not known if ELIQUIS passes into your breast milk. You and your doctor should decide if you will take ELIQUIS or breastfeed. You should not do both

Tell all of your doctors and dentists that you are taking ELIQUIS. They should talk to the doctor who prescribed ELIQUIS for you, before you have **any** surgery, medical or dental procedure. **Tell your doctor about all the medicines you take, including** prescription and over-the-counter medicines, vitamins, and herbal supplements. Some of your other medicines may affect the way ELIQUIS works. Certain medicines may increase your risk of bleeding or stroke when taken with ELIQUIS.

### How should I take ELIQUIS?

#### Take ELIQUIS exactly as prescribed by your doctor.

Take ELIQUIS twice every day with or without food, and do not change your dose or stop taking it unless your doctor tells you to. If you miss a dose of ELIQUIS, take it as soon as you remember, and do not take more than one dose at the same time. **Do not run out of ELIQUIS.**

**Refill your prescription before you run out.** When leaving the hospital following hip or knee replacement, be sure that you will have ELIQUIS (apixaban) available to avoid missing any doses. **If you are taking ELIQUIS for atrial fibrillation, stopping ELIQUIS may increase your risk of having a stroke.**

---

### What are the possible side effects of ELIQUIS?

- See “What is the most important information I should know about ELIQUIS?”
- ELIQUIS can cause a skin rash or severe allergic reaction. Call your doctor or get medical help right away if you have any of the following symptoms:
  - chest pain or tightness
  - swelling of your face or tongue
  - trouble breathing or wheezing
  - feeling dizzy or faint

Tell your doctor if you have any side effect that bothers you or that does not go away.

These are not all of the possible side effects of ELIQUIS. For more information, ask your doctor or pharmacist.

Call your doctor for medical advice about side effects. You may report side effects to FDA at 1-800-FDA-1088.

This is a brief summary of the most important information about ELIQUIS. For more information, talk with your doctor or pharmacist, call 1-855-ELIQUIS (1-855-354-7847), or go to [www.ELIQUIS.com](http://www.ELIQUIS.com).

Manufactured by:

Bristol-Myers Squibb Company  
Princeton, New Jersey 08543 USA

Marketed by:

Bristol-Myers Squibb Company  
Princeton, New Jersey 08543 USA  
and  
Pfizer Inc  
New York, New York 10017 USA

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**Bristol-Myers Squibb**





**Assignment: Love Snap** This month we asked you to show us what love looks like. To see more entries and to find future assignments, visit [ngm.com/yourshot/assignments](http://ngm.com/yourshot/assignments).



**Margherita Vitagliano**

Timperley, England

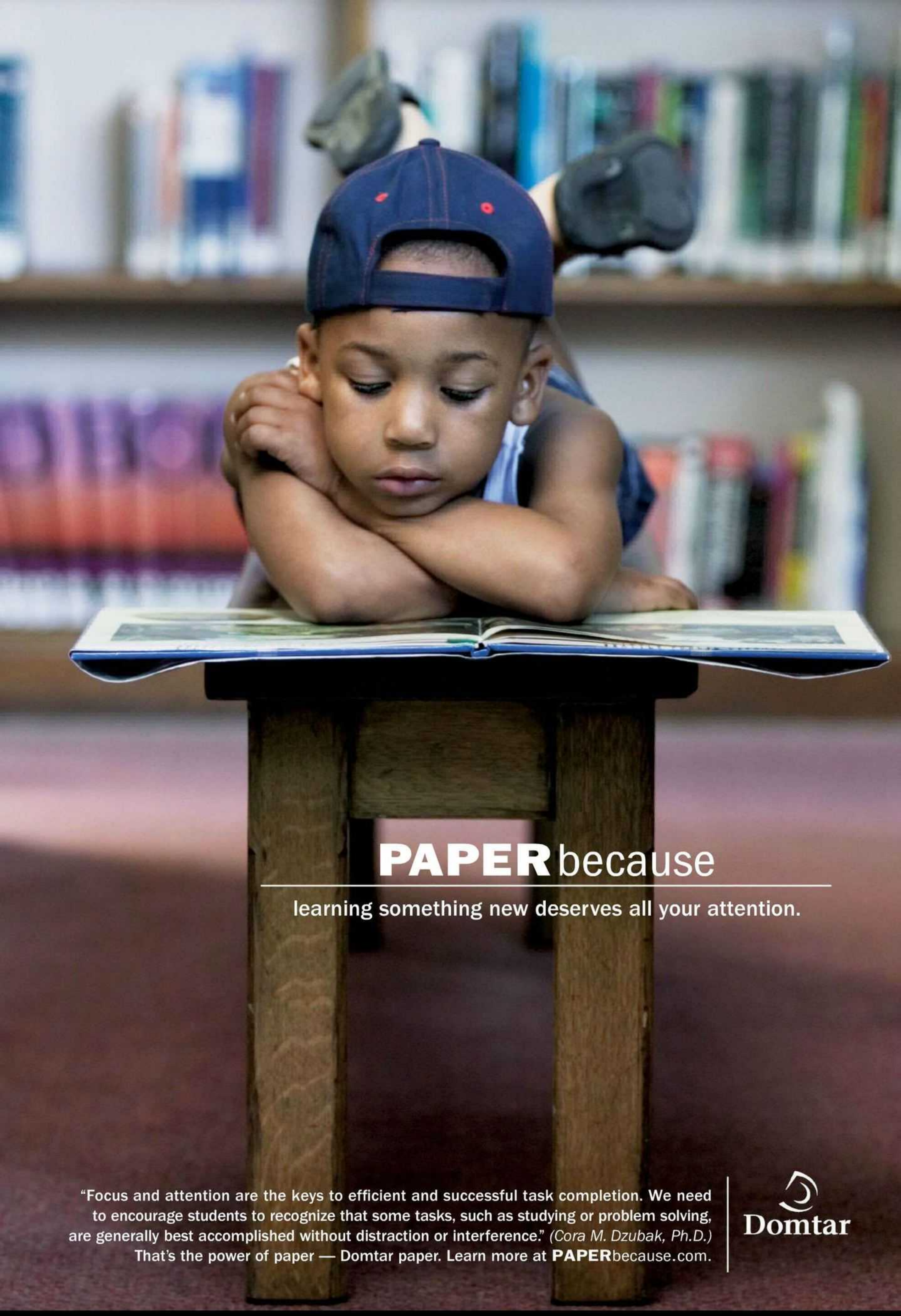
"My grandmother showed me a box full of things belonging to my late grandfather," says Vitagliano, 36. Those included photos of her grandparents when they were young. She asked her grandmother to hold two over her heart to represent "endless love—love forever."

**Rita Thompson**

New York, New York

Thompson shot her daughter and a doll in parallel poses while visiting a designer friend. "My daughter is wearing one of her dresses here. I wanted to show it in a fun way—like I used to hang out in my childhood."





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**Peter Frank**

Bratislava, Slovakia

A bride and groom share a tender moment before their wedding ceremony. Frank, 29, photographed them in a castle in the town of Holič. "I wanted to capture a gentle and honest manifestation of love," he says, "so I asked them to kiss under the veil to create an illusion of privacy."



**Cristian Munteanu** Bucharest, Romania

In Văcărești Pit, an abandoned area outside Bucharest where Roma families live, 35-year-old Munteanu captured a scene of tragic love: Măuța Nedelcu and her husband, Florin, mourning their eight-month-old daughter, Florina, who died the day before when their tent caught fire.



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## Best in Show

More than 7,000 shots were submitted to the 2013 annual National Geographic Photo Contest, representing over 150 countries. Our judges selected images by Paul Souders, Cecile Smetana Baudier, and Adam Tan as winners in the categories of Nature, People, and Places. Souders, the grand-prize winner, received \$10,000 and an invitation to visit National Geographic's headquarters in Washington, D.C.

➤ To enter your best shot, go to [ngphotocontest.com](http://ngphotocontest.com).

### NATURE AND GRAND-PRIZE WINNER

#### **Paul Souders**

Hudson Bay, Canada

During a hot spell, as the setting midnight sun glows red from the smoke of distant fires, a polar bear peeks from beneath the sea ice.

### PEOPLE

#### **Cecile Smetana Baudier**

Fyn, Denmark

Baudier says this portrait of identical twins—15-year-old Nils and Emil—illustrates their different roles in their family.

### PLACES

#### **Adam Tan**

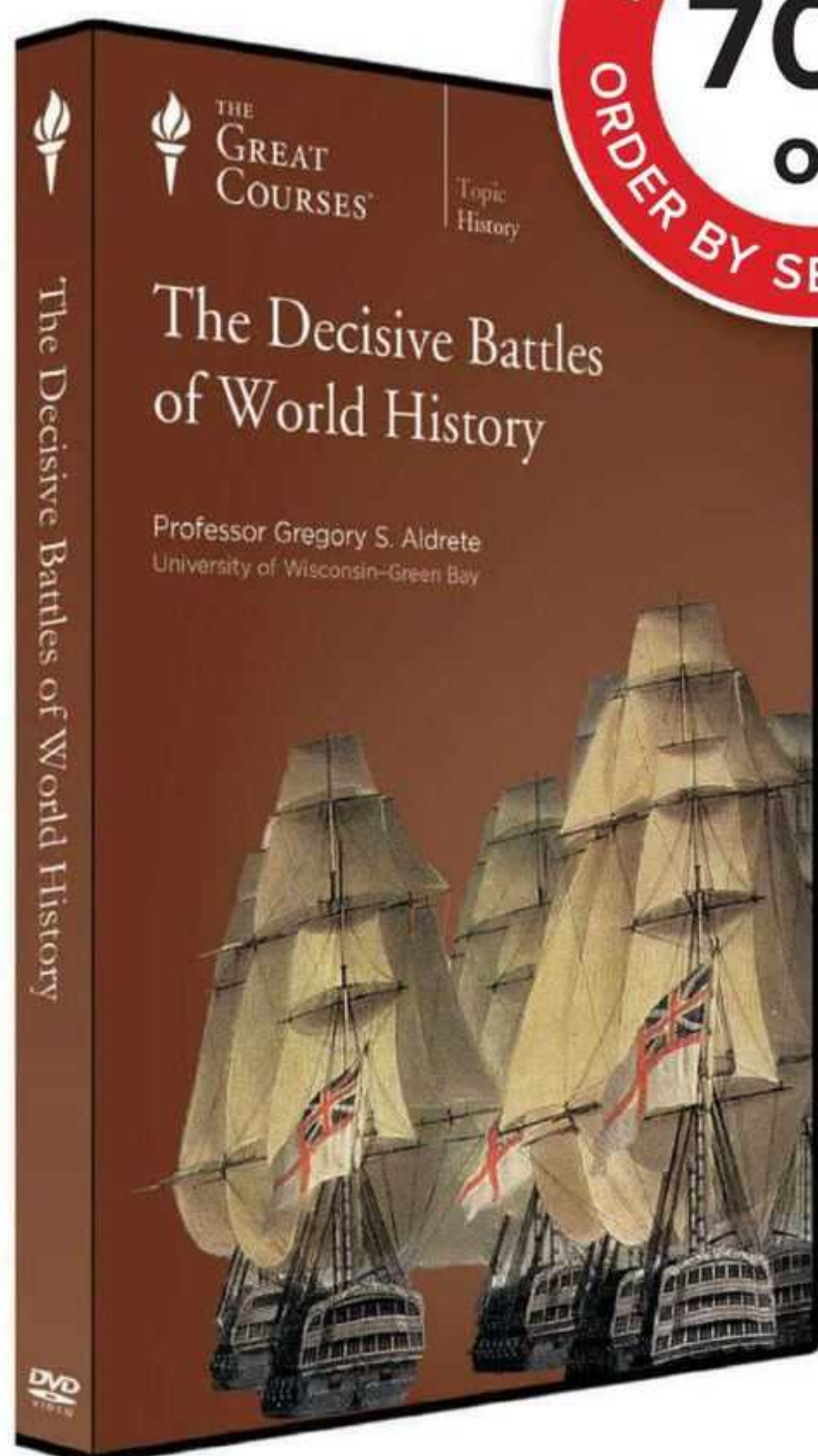
Yuanyang, China

China's rapid growth means this old town may soon look new. To preserve it, Tan took a timeless shot: a mother bearing her child in a basket on a foggy morning.





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5. 197 B.C. Cynoscephalae—Legion vs. Phalanx
6. 31 B.C. Actium—Birth of the Roman Empire
7. 260–110 B.C. China—Struggles for Unification
8. 636 Yarmouk & al-Qadisiyyah—Islam Triumphs
9. 751 Talas & 1192 Tarain—Islam into Asia
10. 1066 Hastings—William Conquers England
11. 1187 Hattin—Crusader Desert Disaster
12. 1260 Ain Jalut—Can the Mongols Be Stopped?
13. 1410 Tannenberg—Cataclysm of Knights
14. Frigidus, Badr, Diu—Obscure Turning Points
15. 1521 Tenochtitlán—Aztecs vs. Conquistadors
16. 1532 Cajamarca—Inca vs. Conquistadors
17. 1526 & 1556 Panipat—Babur & Akbar in India
18. 1571 Lepanto—Last Gasp of the Galleys
19. 1592 Sacheon—Yi's Mighty Turtle Ships
20. 1600 Sekigahara—Samurai Showdown
21. 1683 Vienna—The Great Ottoman Siege
22. 1709 Poltava—Sweden's Fall, Russia's Rise
23. 1759 Quebec—Battle for North America
24. 1776 Trenton—The Revolution's Darkest Hour
25. 1805 Trafalgar—Nelson Thwarts Napoleon
26. 1813 Leipzig—The Grand Coalition
27. 1824 Ayacucho—South American Independence
28. 1836 San Jacinto—Mexico's Big Loss
29. 1862 Antietam—The Civil War's Bloodiest Day
30. 1866 Königgrätz—Bismarck Molds Germany
31. 1905 Tsushima—Japan Humiliates Russia
32. 1914 Marne—Paris Is Saved
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# NEXT

## SKYCAST

Overhead this month  
in parts of the world



September 28  
Saturn visible

## Surf's Down

The central east coast of Australia attracts surfers from around the world, but climate change is likely to leave them less stoked by Aussie swells. Researchers predict that by 2100, rising temperatures will reduce the number of regional storms that cause big waves. "The storms that do occur could become more intense," says Andrew Dowdy of the Centre for Australian Weather and Climate Research, but there will be "fewer days with large waves"—up to 28 percent fewer days for surfers to ride waves that crest 18 feet or higher. Bummer, man. —Rachel Hartigan Shea

### Annual number of storm days

Based on an intermediate greenhouse gas emission scenario



PHOTO: HO NEW, REUTERS. GRAPHIC: LAWSON PARKER, NGM STAFF  
SOURCE: ANDREW J. DOWDY, CENTRE FOR AUSTRALIAN WEATHER AND CLIMATE RESEARCH



# Edible Insects

As incomes rise in developing countries, so too does the demand for meat. But raising livestock uses a lot of resources. Eating insects—already common in many tropical countries—could be an alternative. Beetles and crickets, for example, are packed with nutrients and provide protein at a low environmental cost.

Palatability poses a problem. “People have an emotional response to bugs—it’s the yuck factor,” says Arnold van Huis of Wageningen University in the Netherlands. To disguise their form, insects can be processed into powders or pastes. What’s next? Protein-rich “bug flours” that are part flour and part ground insect will likely be on the market soon.

—Kelsey Nowakowski

## ON THE MENU

2 billion

MORE THAN A FOURTH OF THE WORLD’S PEOPLE EAT INSECTS. The popularity of Western diets is reducing insect consumption in developing countries.

2,000  
NUMBER OF KNOWN EDIBLE SPECIES

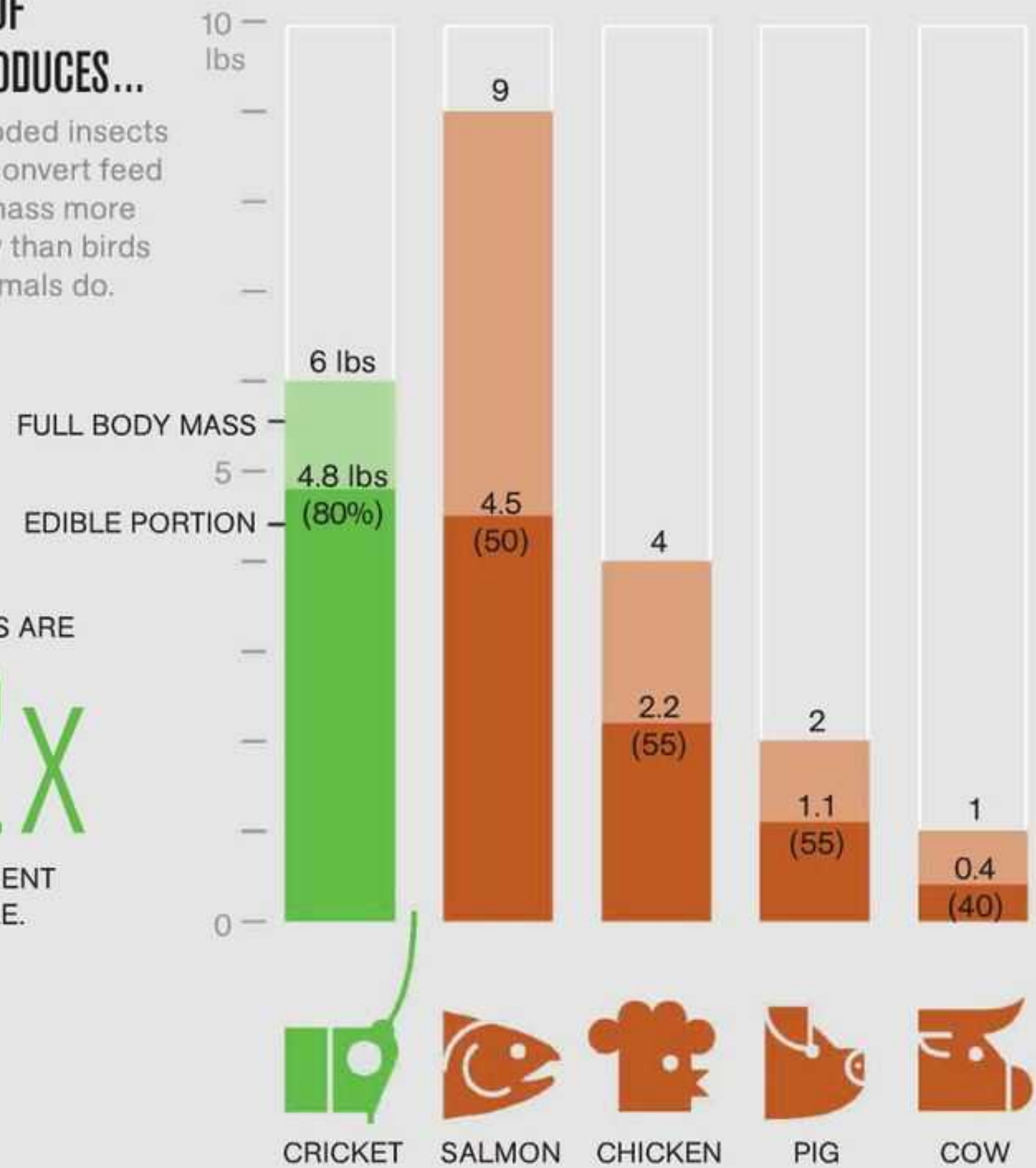
## EFFICIENT PROTEIN

Edible insects provide a sustainable alternative to meat. They are a healthy food source with a high protein and fat content, but their nutritional value varies by species.

### 10 LBS OF FEED PRODUCES...

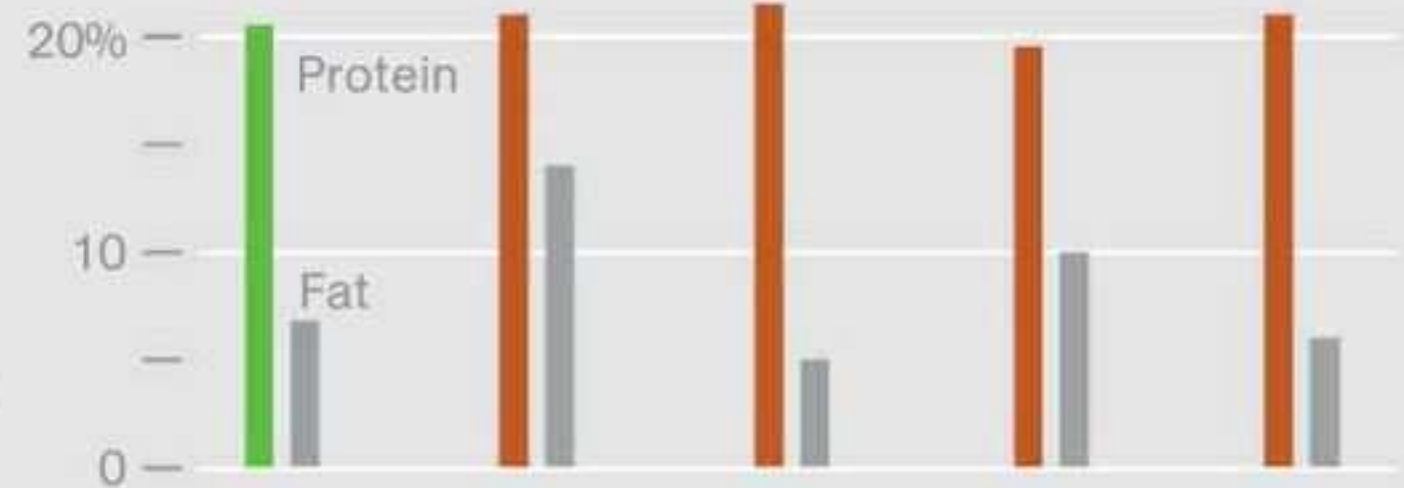
Cold-blooded insects and fish convert feed to body mass more efficiently than birds and mammals do.

CRICKETS ARE  
**12x**  
AS EFFICIENT AS CATTLE.



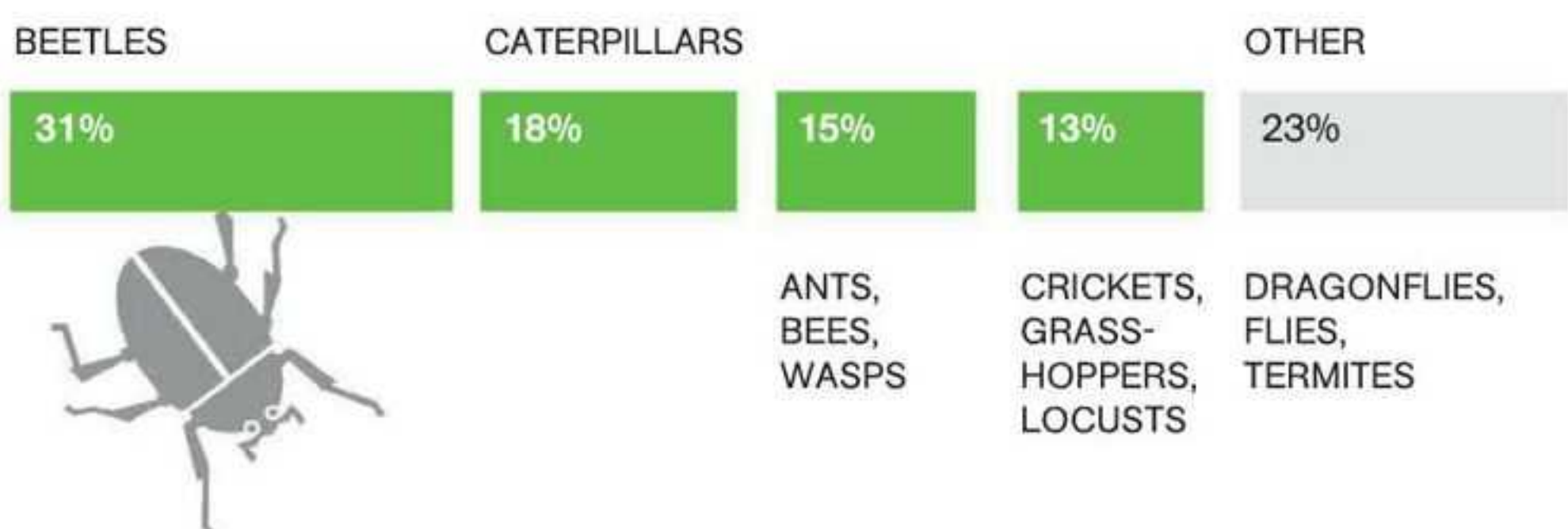
### NUTRITIONAL VALUE

The percent of protein and fat in crickets is similar to that of most meats.

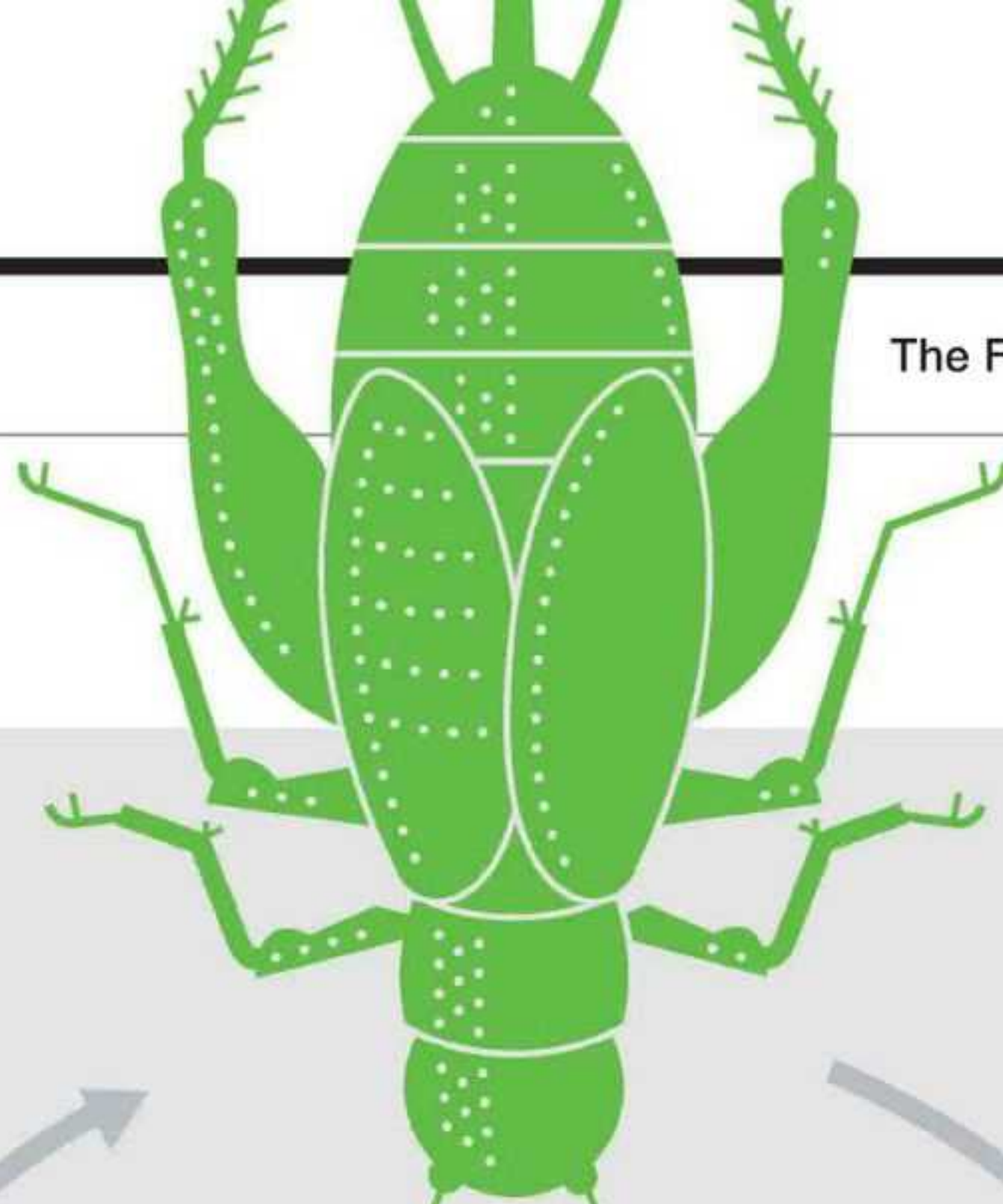


### MOST COMMONLY CONSUMED

Beetles are the most consumed species; mealworms are beetle larvae.







**INSECT FARMING**  
Most farmed insects are used as animal feed, but large-scale farming for human consumption is planned.



**WASTE**  
Insects like flies and mealworms can convert low-value organic waste into high-value protein.



**PRODUCTION**  
The cost of raising insects can be competitive if efficient, automated systems are used.

**A CIRCULAR ECONOMY**

Investing in insect production can help meet the growing demand for affordable protein while having a minimal impact on the environment.



**PRODUCTS**

Increased aquacultural production and high fish-meal prices are driving research on insect-based feed. People eat insects, and industries use them in medicines, to color lipstick, and to flavor alcohol.

**ENVIRONMENTAL IMPACT**

Insects emit fewer greenhouse gases and require less land to produce than livestock such as pigs and cattle.

**GREENHOUSE GAS PRODUCTION**  
Pounds of CO<sub>2</sub>-eq\* generated from producing a pound of protein



MEALWORM PIG

**LAND USE**  
Square feet needed to produce a pound of protein



MEALWORM PIG

**A DELICACY**

IN UGANDA A POUND OF GRASSHOPPERS COSTS

**40%**

MORE THAN A POUND OF BEEF

\*CO<sub>2</sub> equivalents: the sum of carbon dioxide, methane, and nitrous oxide emissions

GRAPHICS: ÁLVARO VALIÑO. SOURCES: FAO; ARNOLD VAN HUIS, WAGENINGEN UNIVERSITY, THE NETHERLANDS; NEW GENERATION NUTRITION, THE NETHERLANDS





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Places

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# KEEP IT WILD



01

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03

02

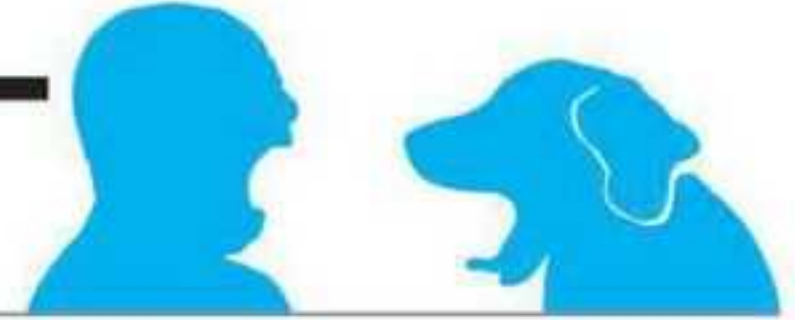
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**Skintight Space Suit** When humans set foot on Mars, what will protect them from the red planet's atmosphere? Massachusetts Institute of Technology aeronautics professor Dava Newman (above) hopes it's the BioSuit she's developing. To create a livable atmospheric pressure in the weightless vacuum of space, astronauts now wear bulky, gas-inflated suits that weigh about 300 pounds. Newman's prototype uses plastic, elastic, and shape-retaining "memory alloys" to essentially shrink-wrap space travelers. The fully pressurized, highly flexible suit weighs about 45 pounds. And while a rip in today's suits would cause pressure loss and abort a space walk, Newman's suit can be patched in real time with a kind of galactic elastic bandage. —*Patricia Edmonds*

## Literacy List

Washington is first in war, first in peace, and first in...literacy?

For the fourth year in a row D.C. is America's most literate city, says John Miller, president of Central Connecticut State University. Since 2003 he's ranked U.S. cities of 250,000 plus—this year 77 in all—based on "bookstores, educational attainment, Internet resources, periodical publishing, and newspaper circulation."

Miller gauges people's "literate behavior—not can they read, but do they." For last place Bakersfield, California, it may be time to turn the page. —*Jeremy Berlin*

- 1 Washington, DC
- 2 Seattle, WA
- 3 Minneapolis, MN
- 4 Atlanta, GA\*
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# The Great Energy Challenge



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energy questions  
of our time?



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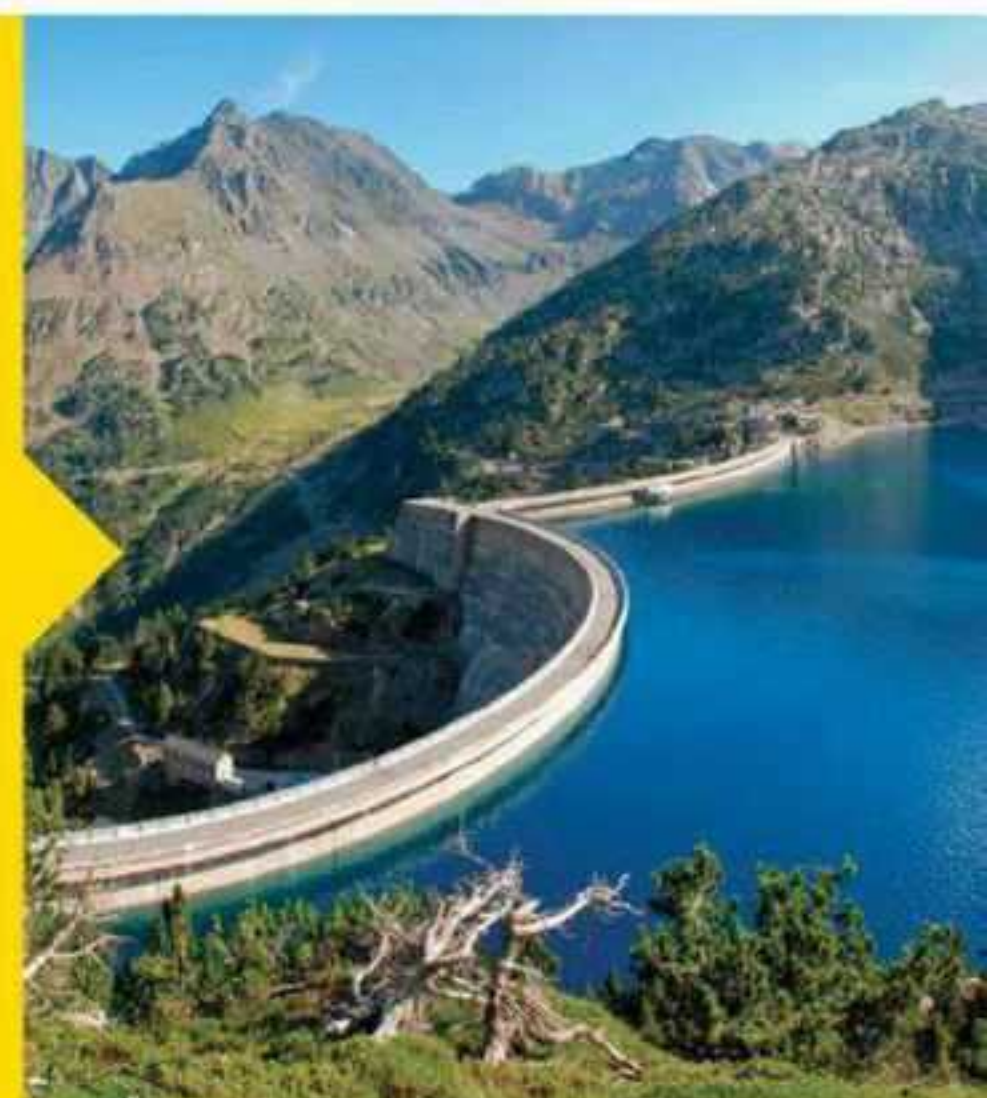
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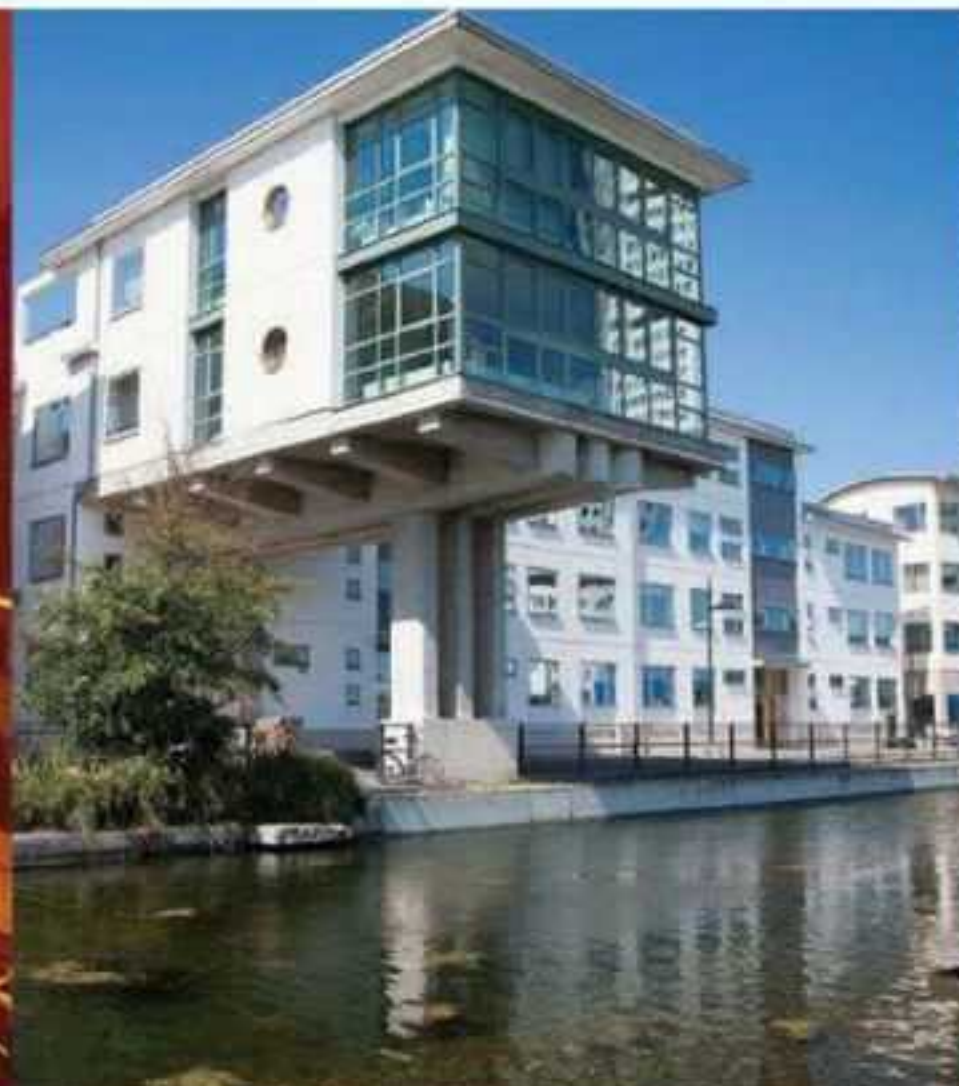


The global program includes [greatenergychallenge.com](http://greatenergychallenge.com), a comprehensive digital site featuring regular reporting; a series of grants that support innovative energy projects around the world; and a roundtable discussion series, **The Big Energy Question**.



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The Earth's growing population and limited resources mean that innovative ideas are critical for energy conservation, generation, and distribution. That's why the Great Energy Challenge has awarded 22 grants to support projects that focus on energy solutions. These projects, while local, are intended to have potential for regional and global scalability.



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SOLAR ELECTRIC LIGHT FUND Sub-Saharan Africa		LEGACY FOUNDATION Latin America	GHONSLA South Asia	INTERNATIONAL DEVELOPMENT ENTERPRISES South Asia	
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## A Message From Shell

**BEN VAN BEURDEN**  
CEO, Royal Dutch Shell

"Collaboration is pivotal to thinking and planning for the future of energy: not just for Shell, but for all of us who rely on it as a vital part of our daily lives. That's why Shell is partnering with National Geographic in The Great Energy Challenge. This global initiative facilitates cutting-edge thinking from leading energy experts and concerned citizens. We invite you to join us as we explore new solutions for a sustainable future."

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National Geographic has assembled some of the world's foremost researchers and scientists to help tackle the challenge. Meet the distinguished panel of advisors who help identify and evaluate projects for Great Energy Challenge grants.

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**Sally M. Benson**, Director, Global Climate and Energy Project Research Professor, School of Earth Sciences, Stanford University

**José Goldemberg**, Professor, University of São Paulo, Former Environment Minister in Brazil

**Daniel Kammen**, Class of 1935 Distinguished Professor of Energy, University of California, Berkeley, Co-Director, Berkeley Institute of the Environment

**Amory Lovins**, Co-founder and Chair, Rocky Mountain Institute

**Rajendra K. Pachauri**, Chair, Intergovernmental Panel on Climate Change, Director-General, The Energy and Resources Institute

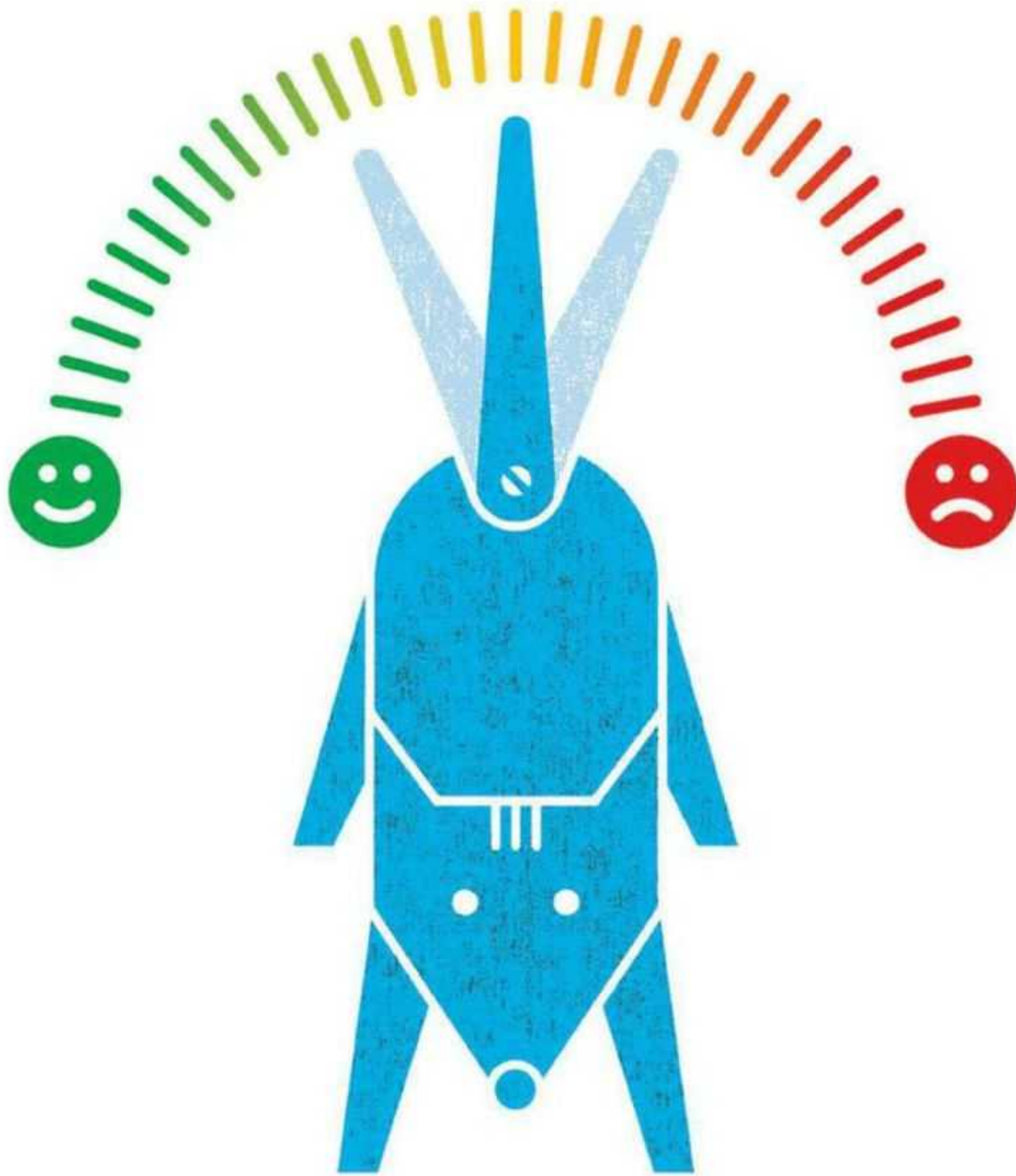


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Learn more and do more at

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## Heads and Tails

A dog wags its tail to express emotion. Now researchers have begun to interpret certain tail movements. When viewed in slow motion, wagging back and forth—commonly thought to signal happiness—actually leans more to one side or the other. A recent study found that wags to the right imply that a dog is excited, such as when viewing an owner or a friendly dog. Wags to the left reveal nervousness, often around perceived threats. According to University of Trento neuroscientist Giorgio Vallortigara, the movements are a result of cognitive asymmetry, where one hemisphere of the brain controls the opposite side of the body. By watching closely, some dogs can recognize each other's moods based on subtle flicks of the tail. —Daniel Stone

### THE LIST

**Cold Words** Dialects of Alaskan Inupiaq have about a hundred words for sea ice. These definitions are from the *Wales Inupiaq Sea Ice Dictionary*. —Eve Conant

#### *Auniq*

Thin, rotting, and unsafe ice with melted holes

#### *Analuaq*

Part of an ice floe covered by walrus excrement

#### *Utuqaq*

Ice that appears in the Bering Strait every November

#### *Mitivik*

Crystals of ice floating in seawater or a fishing hole

#### *Qaaptiniq*

Water splashed around a seal's breathing hole in the ice

#### *Tuwaiyauti (verb)*

To drift away on a piece of ice





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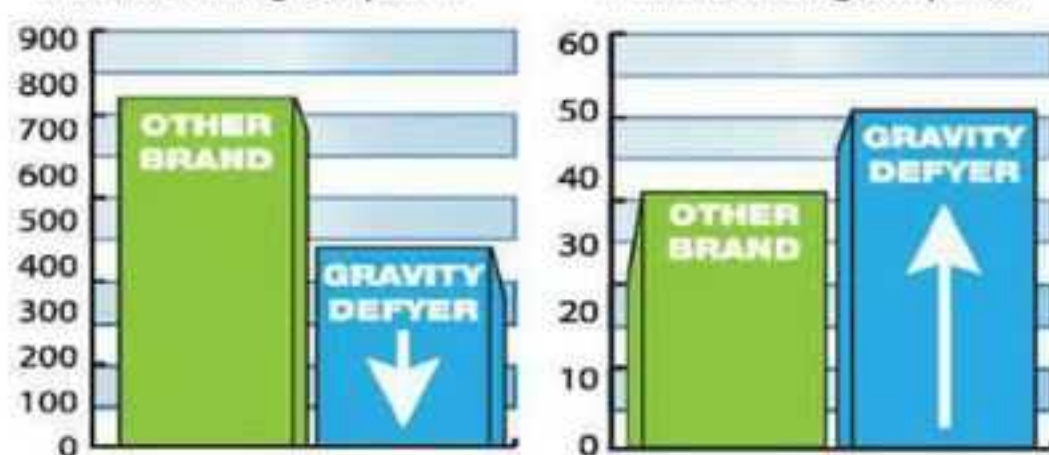
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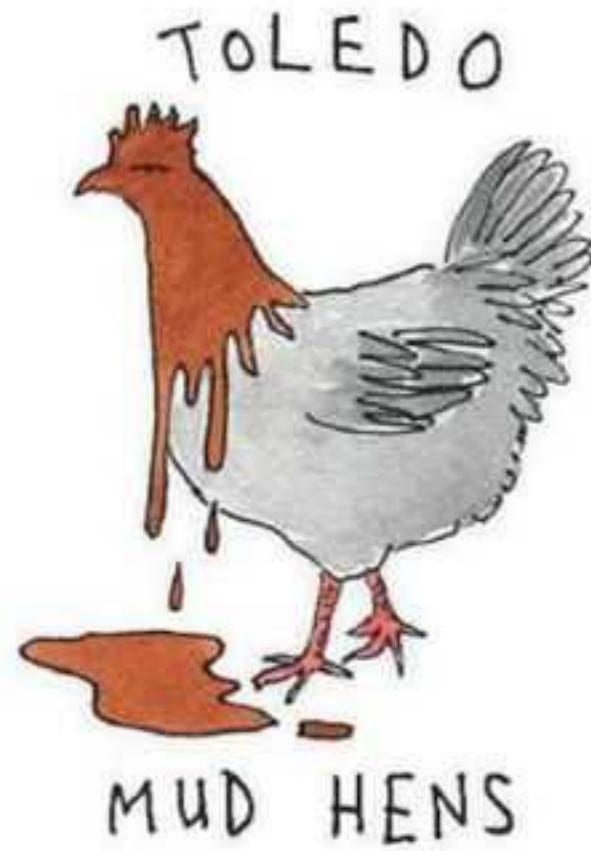
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# Who's on First?

Impatient for the World Series? To tide you over until October, there's this month's Triple-A championship game in Charlotte, North Carolina. It caps the season for minor league baseball's 19 affiliated leagues, whose teams step up to the plate with some of the most colorful monikers in sports.

Rather than mirror the name of their major league affiliates, farm clubs have gotten creative. They draw names from local delicacies, wildlife, history, industry—or imagination. How else to explain the Vermont Lake Monsters? —*Tim Wendel*



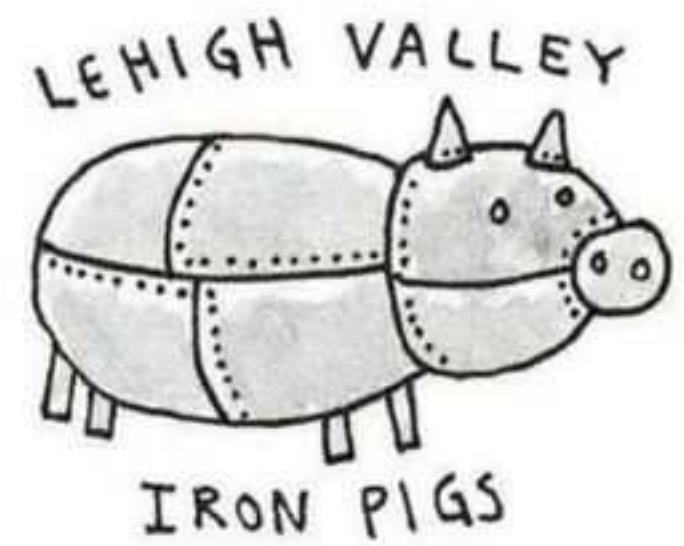
Hatched in 1896, this nickname could be worse: This marsh bird is also known as the American coot.



The team name honors rock-and-roll, as does the guitar-toting, Elvis-channeling cat mascot.



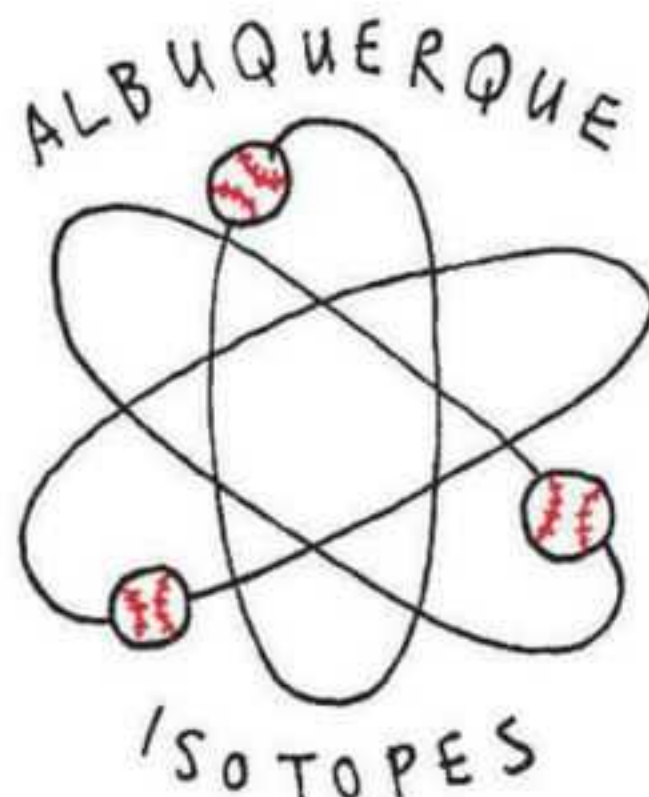
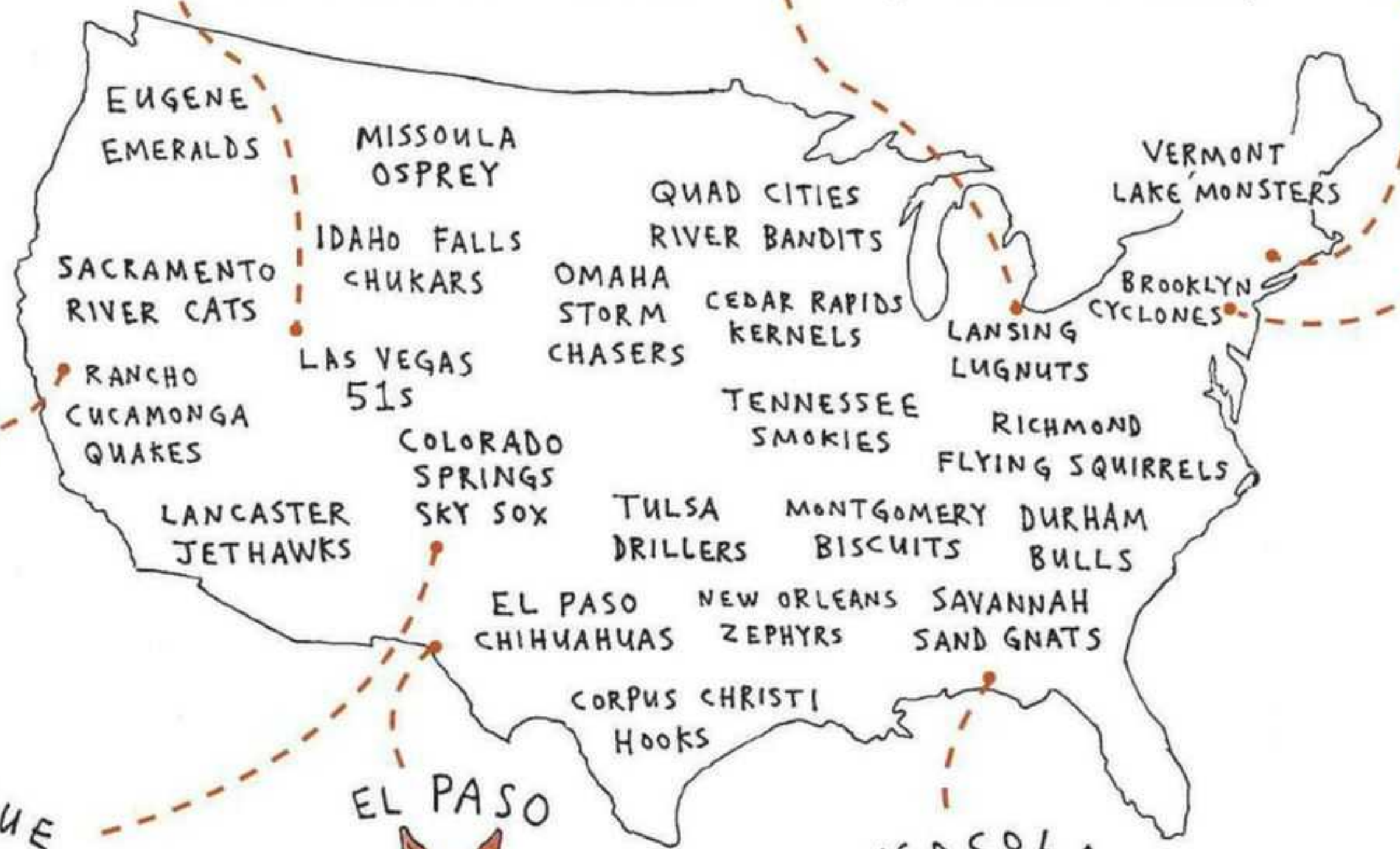
Once the San Francisco Mission Wolves, the team was renamed when it moved to the Beehive State.



No pigs were harmed in the making of this play on words: Pig iron is used in steelmaking.



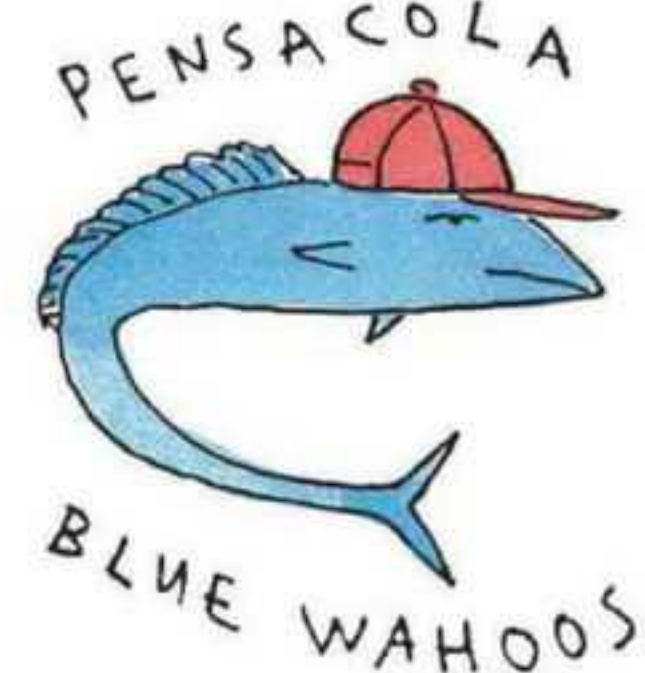
Like its almond-and-walnut logo, the team's name honors crops grown in the region.



This team took its nickname from the fictional Springfield Isotopes on the TV series *The Simpsons*.



This San Diego Padres farm team lets fans bring their dogs on "Bark at the Park" game day.



The former Carolina Mudcats took their fishy name upon moving to Florida in 2012.





ESCARGOTS, SARDINES, AND FAVA BEANS, CRETE



NAAN IN SALTY YAK-MILK TEA, AFGHANISTAN



FRIED GERANIUM LEAVES, CRETE



DRIED-APRICOT SOUP, PAKISTAN



BOILED PLANTAINS, BOLIVIA



FRIED CORAL REEF FISH, MALAYSIA



GRILLED TUNA, MALAYSIA



COOKED POTATOES, TOMATOES, AND FAVA BEANS IN OLIVE OIL, CRETE



RICE WITH MELTIED YAK BUTTER, AFGHANISTAN





BOILED CRAB, MALAYSIA



RAW BEETROOT AND ORANGES, CRETE



CHAPATI, YAK BUTTER, AND ROCK SALT, PAKISTAN



BULGUR, BOILED EGGS, AND PARSLEY, TAJIKISTAN



STEWED SEAWEED SALAD, MALAYSIA



BOILED PTARMIGAN, GREENLAND



FRIED FISH WITH TAMARIND, MALAYSIA



DRIED APRICOTS, PAKISTAN



GRILLED IMPALA, TANZANIA (PHOTOGRAPHER'S UTENSILS)



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By 2050 we'll need to feed two billion more people. This special eight-month series explores how we can do that — without overwhelming the planet.

Could eating like our ancestors make us healthier?

*Some experts say modern diets should eat from a Stone Age menu. What's on it may surprise you.*

# *The* Evolution of Diets

By *Ann Gibbons*

Photographs by *Matthieu Paley*



*Modern humans  
the Age menu.  
surprise you.*

**tion**  
**et**



Honey is an essential energy source for the Hadza people of Tanzania.





*It's suppertime in the Amazon of lowland Bolivia, and Ana Cuata Maito is stirring a porridge of plantains and sweet manioc over a fire smoldering on the dirt floor of her thatched hut, listening for the voice of her husband as he returns from the forest with his scrawny hunting dog.*

With an infant girl nursing at her breast and a seven-year-old boy tugging at her sleeve, she looks spent when she tells me that she hopes her husband, Deonicio Nate, will bring home meat tonight. “The children are sad when there is no meat,” Maito says through an interpreter, as she swats away mosquitoes.

Nate left before dawn on this day in January with his rifle and machete to get an early start on the two-hour trek to the old-growth forest. There he silently scanned the canopy for brown capuchin monkeys and raccoonlike coatis, while his dog sniffed the ground for the scent of pig-like peccaries or reddish brown capybaras. If he was lucky, Nate would spot one of the biggest packets of meat in the forest—tapirs, with long, prehensile snouts that rummage for buds and shoots among the damp ferns.

This evening, however, Nate emerges from the forest with no meat. At 39, he's an energetic guy who doesn't seem easily defeated—when he isn't hunting or fishing or weaving palm fronds into roof panels, he's in the woods carving a new canoe

from a log. But when he finally sits down to eat his porridge from a metal bowl, he complains that it's hard to get enough meat for his family: two wives (not uncommon in the tribe) and 12 children. Loggers are scaring away the animals. He can't fish on the river because a storm washed away his canoe.

The story is similar for each of the families I visit in Anachere, a community of about 90 members of the ancient Tsimane Indian tribe. It's the rainy season, when it's hardest to hunt or fish. More than 15,000 Tsimane live in about a hundred villages along two rivers in the Amazon Basin near the main market town of San Borja, 225 miles from La Paz. But Anachere is a two-day trip from San Borja by motorized dugout canoe, so the Tsimane living there still get most of their food from the forest, the river, or their gardens.

I'm traveling with Asher Rosinger, a doctoral candidate who's part of a team, co-led by biological anthropologist William Leonard of Northwestern University, studying the Tsimane to document what a rain forest diet looks

José Mayer Cunay, 78, looks for plantains ready to be picked near his *chaco*, a half-acre agricultural plot that the Tsimane elder and his son Felipe Mayer Lero created in the Bolivian Amazon using slash-and-burn techniques. Four generations of the family eat the fruit, corn, and other crops grown here, but the foods they prize most must be pursued: fish, fowl, and game.





**The Tsimane of Bolivia**  
get most of their food  
from the river, the forest,  
or fields and gardens  
carved out of the forest.



Flood-driven debris clogs the Maniqui River shallows where Cunay bathes. A great orange tip butterfly, common in the Amazon, casts a shadow on his back. Even in old age, most Tsimane remain lean from walking miles a day to gather enough food to survive.









like. They're particularly interested in how the Indians' health changes as they move away from their traditional diet and active lifestyle and begin trading forest goods for sugar, salt, rice, oil, and increasingly, dried meat and canned sardines. This is not a purely academic inquiry. What anthropologists are learning about the diets of indigenous peoples like the Tsimane could inform what the rest of us should eat.

Rosinger introduces me to a villager named José Mayer Cunay, 78, who, with his son Felipe Mayer Lero, 39, has planted a lush garden by the river over the past 30 years. José leads us down a trail past trees laden with golden papayas and mangoes, clusters of green plantains, and orbs of grapefruit that dangle from branches

put, a diet that revolves around meat and dairy, a way of eating that's on the rise throughout the developing world, will take a greater toll on the world's resources than one that revolves around unrefined grains, nuts, fruits, and vegetables.

Until agriculture was developed around 10,000 years ago, all humans got their food by hunting, gathering, and fishing. As farming emerged, nomadic hunter-gatherers gradually were pushed off prime farmland, and eventually they became limited to the forests of the Amazon, the arid grasslands of Africa, the remote islands of Southeast Asia, and the tundra of the Arctic. Today only a few scattered tribes of hunter-gatherers remain on the planet.

That's why scientists are intensifying efforts to

## **A diet that revolves around meat and dairy will take a greater toll on the world's resources than one based on unrefined grains, nuts, fruits, and vegetables.**

like earrings. Vibrant red "lobster claw" heliconia flowers and wild ginger grow like weeds among stalks of corn and sugarcane. "José's family has more fruit than anyone," says Rosinger.

Yet in the family's open-air shelter Felipe's wife, Catalina, is preparing the same bland porridge as other households. When I ask if the food in the garden can tide them over when there's little meat, Felipe shakes his head. "It's not enough to live on," he says. "I need to hunt and fish. My body doesn't want to eat just these plants."

AS WE LOOK TO 2050, when we'll need to feed two billion more people, the question of which diet is best has taken on new urgency. The foods we choose to eat in the coming decades will have dramatic ramifications for the planet. Simply

---

*Ann Gibbons is the author of The First Human: The Race to Discover Our Earliest Ancestors. Matthieu Paley photographed Afghanistan's Kyrgyz for our February 2013 issue.*

learn what they can about an ancient diet and way of life before they disappear. "Hunter-gatherers are not living fossils," says Alyssa Crittenden, a nutritional anthropologist at the University of Nevada, Las Vegas, who studies the diet of Tanzania's Hadza people, some of the last true hunter-gatherers. "That being said, we have a small handful of foraging populations that remain on the planet. We are running out of time. If we want to glean any information on what a nomadic, foraging lifestyle looks like, we need to capture their diet now."

So far studies of foragers like the Tsimane, Arctic Inuit, and Hadza have found that these peoples traditionally didn't develop high blood pressure, atherosclerosis, or cardiovascular disease. "A lot of people believe there is a discordance between what we eat today and what our ancestors evolved to eat," says paleoanthropologist Peter Ungar of the University of Arkansas. The notion that we're trapped in Stone Age bodies in a fast-food world (Continued on page 50)



## We'll Have What They're Having

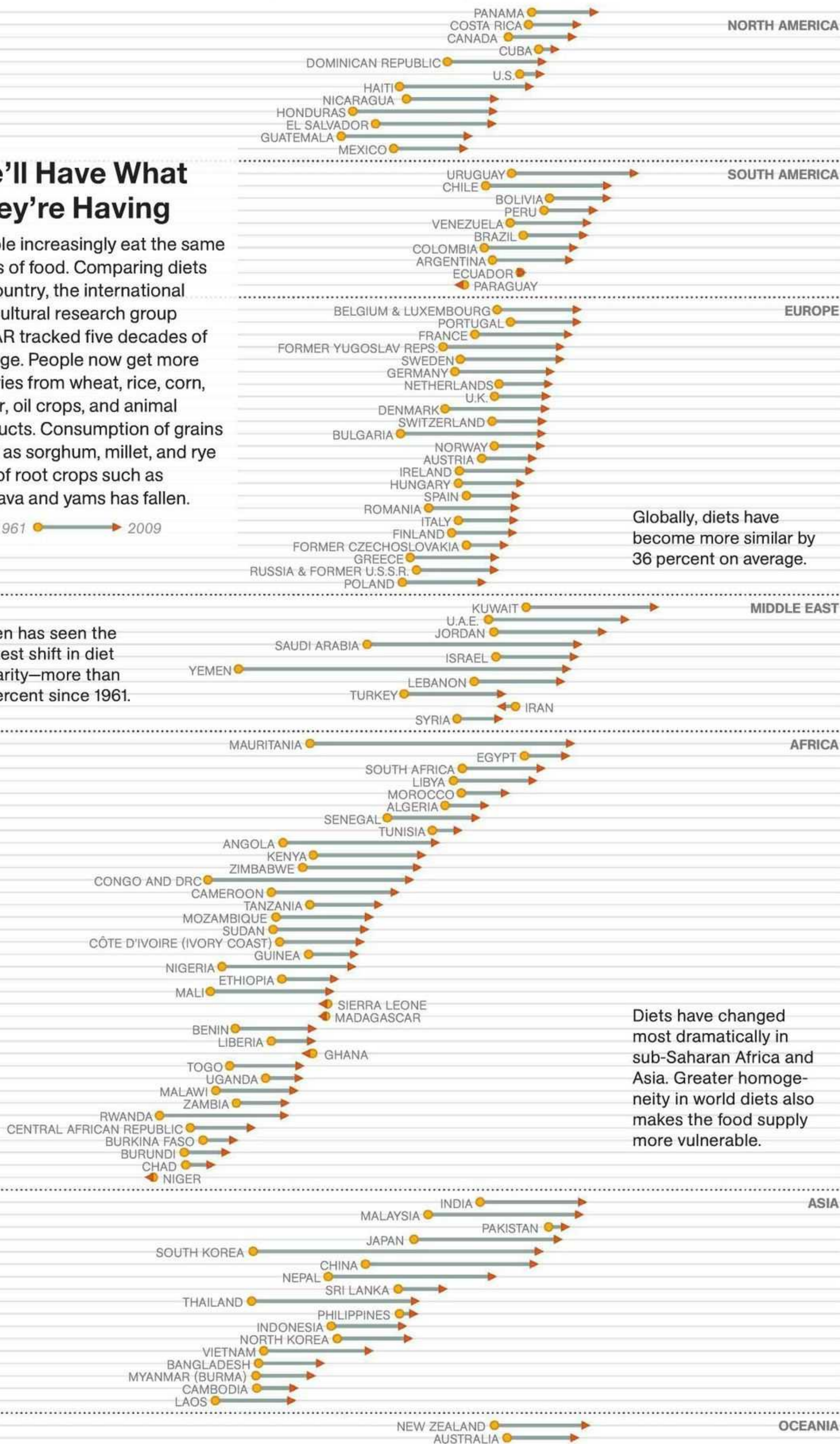
People increasingly eat the same types of food. Comparing diets by country, the international agricultural research group CGIAR tracked five decades of change. People now get more calories from wheat, rice, corn, sugar, oil crops, and animal products. Consumption of grains such as sorghum, millet, and rye and of root crops such as cassava and yams has fallen.

1961 ● → 2009

Yemen has seen the greatest shift in diet similarity—more than 50 percent since 1961.

Globally, diets have become more similar by 36 percent on average.

Diets have changed most dramatically in sub-Saharan Africa and Asia. Greater homogeneity in world diets also makes the food supply more vulnerable.



Only countries with populations greater than three million shown. Some country names reflect those used in 1961.





Wande and her husband, Moko, set out to find food. She uses a blade-tipped stick to dig tubers, a staple food especially in the rainy season. He brings an ax to extract honeycomb from tree trunks and a bow and arrows for hunting and defense.



**The Hadza of Tanzania are the world's last full-time hunter-gatherers. They live on what they find: game, honey, and plants, including tubers, berries, and baobab fruit.**









Young Hadza hunters survey the Yaeda Valley (below). Their families eat whatever game the hunters bring home; one day's spoils included a bush baby (left). Over the past 50 years most of the tribe's ancestral land has been taken over by herders whose cattle scare off wildlife and by farmers who cut down honey trees to make fences.







The 64 residents of the remote east Greenland village of Isortoq still hunt and fish but combine traditional Inuit foods with purchases from the supermarket, the large red building in the foreground. A favorite dish: seal dipped in ketchup and mayonnaise.



**Greenland's Inuit** survived for generations eating almost nothing but meat in a landscape too harsh for most plants. Today markets offer more variety, but a taste for meat persists.











An Inuit girl feeds her brother (left) a bit of liver from a seal their father has just caught. What's not eaten right away will stay frozen in outdoor sheds; one family's "freezer" (above) holds the meat, ribs, and jaw of a killer whale and the foreflipper of a bearded seal.



is driving the current craze for Paleolithic diets. The popularity of these so-called caveman or Stone Age diets is based on the idea that modern humans evolved to eat the way hunter-gatherers did during the Paleolithic—the period from about 2.6 million years ago to the start of the agricultural revolution—and that our genes haven't had enough time to adapt to farmed foods.

A Stone Age diet “is the one and only diet that ideally fits our genetic makeup,” writes Loren Cordain, an evolutionary nutritionist at Colorado State University, in his book *The Paleo Diet: Lose Weight and Get Healthy by Eating the Foods You Were Designed to Eat*. After studying the diets of living hunter-gatherers and concluding that 73 percent of these societies

Africa, popularized the image of our early ancestors hunting meat to survive on the African savanna. Writing in the 1950s, he described those humans as “carnivorous creatures, that seized living quarries by violence, battered them to death...slaking their ravenous thirst with the hot blood of victims and greedily devouring livid writhing flesh.”

Eating meat is thought by some scientists to have been crucial to the evolution of our ancestors' larger brains about two million years ago. By starting to eat calorie-dense meat and marrow instead of the low-quality plant diet of apes, our direct ancestor, *Homo erectus*, took in enough extra energy at each meal to help fuel a bigger brain. Digesting a higher quality diet

## **The popularity of so-called Stone Age diets is based on the idea that modern humans evolved to eat the way hunter-gatherers did during the Paleolithic period.**

derived more than half their calories from meat, Cordain came up with his own Paleo prescription: Eat plenty of lean meat and fish but not dairy products, beans, or cereal grains—foods introduced into our diet after the invention of cooking and agriculture. Paleo-diet advocates like Cordain say that if we stick to the foods our hunter-gatherer ancestors once ate, we can avoid the diseases of civilization, such as heart disease, high blood pressure, diabetes, cancer, even acne.

That sounds appealing. But is it true that we all evolved to eat a meat-centric diet? Both paleontologists studying the fossils of our ancestors and anthropologists documenting the diets of indigenous people today say the picture is a bit more complicated. The popular embrace of a Paleo diet, Ungar and others point out, is based on a stew of misconceptions.

MEAT HAS PLAYED a starring role in the evolution of the human diet. Raymond Dart, who in 1924 discovered the first fossil of a human ancestor in

and less bulky plant fiber would have allowed these humans to have much smaller guts. The energy freed up as a result of smaller guts could be used by the greedy brain, according to Leslie Aiello, who first proposed the idea with paleo-anthropologist Peter Wheeler. The brain requires 20 percent of a human's energy when resting; by comparison, an ape's brain requires only 8 percent. This means that from the time of *H. erectus*, the human body has depended on a diet of energy-dense food—especially meat.

Fast-forward a couple of million years to when the human diet took another major turn with the invention of agriculture. The domestication of grains such as sorghum, barley, wheat, corn, and rice created a plentiful and predictable food supply, allowing farmers' wives to bear babies in rapid succession—one every 2.5 years instead of one every 3.5 years for hunter-gatherers. A population explosion followed; before long, farmers outnumbered foragers.

Over the past decade anthropologists have



struggled to answer key questions about this transition. Was agriculture a clear step forward for human health? Or in leaving behind our hunter-gatherer ways to grow crops and raise livestock, did we give up a healthier diet and stronger bodies in exchange for food security?

When biological anthropologist Clark Spencer Larsen of Ohio State University describes the dawn of agriculture, it's a grim picture. As the earliest farmers became dependent on crops, their diets became far less nutritionally diverse than hunter-gatherers' diets. Eating the same domesticated grain every day gave early farmers cavities and periodontal disease rarely found in hunter-gatherers, says Larsen. When farmers began domesticating animals, those cattle, sheep, and goats became sources of milk and meat but also of parasites and new infectious diseases. Farmers suffered from iron deficiency and developmental delays, and they shrank in stature.

Despite boosting population numbers, the lifestyle and diet of farmers were clearly not as healthy as the lifestyle and diet of hunter-gatherers. That farmers produced more babies, Larsen says, is simply evidence that "you don't have to be disease free to have children."

THE REAL PALEOLITHIC DIET, though, wasn't all meat and marrow. It's true that hunter-gatherers around the world crave meat more than any other food and usually get around 30 percent of their annual calories from animals. But most also endure lean times when they eat less than a handful of meat each week. New studies suggest that more than a reliance on meat in ancient human diets fueled the brain's expansion.

Year-round observations confirm that hunter-gatherers often have dismal success as hunters. The Hadza and Kung bushmen of Africa, for example, fail to get meat more than half the time when they venture forth with bows and arrows. This suggests it was even harder for our ancestors who didn't have these weapons. "Everybody thinks you wander out into the savanna and there are antelopes everywhere, just waiting for you to bonk them on the head," says paleoanthropologist Alison Brooks of George Washington University,

an expert on the Dobe Kung of Botswana. No one eats meat all that often, except in the Arctic, where Inuit and other groups traditionally got as much as 99 percent of their calories from seals, narwhals, and fish.

So how do hunter-gatherers get energy when there's no meat? It turns out that "man the hunter" is backed up by "woman the forager," who, with some help from children, provides more calories during difficult times. When meat, fruit, or honey is scarce, foragers depend on "fallback foods," says Brooks. The Hadza get almost 70 percent of their calories from plants. The Kung traditionally rely on tubers and mongongo nuts, the Aka and Baka Pygmies of the Congo River Basin on yams, the Tsimane and Yanomami Indians of the Amazon on plantains and manioc, the Australian Aboriginals on nut grass and water chestnuts.

"There's been a consistent story about hunting defining us and that meat made us human," says Amanda Henry, a paleobiologist at the Max Planck Institute for Evolutionary Anthropology in Leipzig. "Frankly, I think that misses half of the story. They want meat, sure. But what they actually live on is plant foods." What's more, she found starch granules from plants on fossil teeth and stone tools, which suggests humans may have been eating grains, as well as tubers, for at least 100,000 years—long enough to have evolved the ability to tolerate them.

The notion that we stopped evolving in the Paleolithic period simply isn't true. Our teeth, jaws, and faces have gotten smaller, and our DNA has changed since the invention of agriculture. "Are humans still evolving? Yes!" says geneticist Sarah Tishkoff of the University of Pennsylvania.

One striking piece of evidence is lactose tolerance. All humans digest mother's milk as infants, but until cattle began being domesticated 10,000 years ago, weaned children no longer needed to digest milk. As a result, they stopped making the

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The magazine thanks The Rockefeller Foundation and members of the National Geographic Society for their generous support of this series of articles.



enzyme lactase, which breaks down the lactose into simple sugars. After humans began herding cattle, it became tremendously advantageous to digest milk, and lactose tolerance evolved independently among cattle herders in Europe, the Middle East, and Africa. Groups not dependent on cattle, such as the Chinese and Thai, the Pima Indians of the American Southwest, and the Bantu of West Africa, remain lactose intolerant.

Humans also vary in their ability to extract sugars from starchy foods as they chew them, depending on how many copies of a certain gene they inherit. Populations that traditionally ate more starchy foods, such as the Hadza, have more copies of the gene than the Yakut meat-eaters of Siberia, and their saliva helps break down

meat, yet they had almost no heart disease until after the fall of the Soviet Union, when many settled in towns and began eating market foods. Today about half the Yakut living in villages are overweight, and almost a third have hypertension, says Leonard. And Tsimane people who eat market foods are more prone to diabetes than those who still rely on hunting and gathering.

For those of us whose ancestors were adapted to plant-based diets—and who have desk jobs—it might be best not to eat as much meat as the Yakut. Recent studies confirm older findings that although humans have eaten red meat for two million years, heavy consumption increases atherosclerosis and cancer in most populations—and the culprit isn't just saturated

## **The real hallmark of being human isn't our taste for meat but our ability to adapt to many habitats and to create many healthy diets.**

starches before the food reaches their stomachs.

These examples suggest a twist on “You are what you eat.” More accurately, you are what your ancestors ate. There is tremendous variation in what foods humans can thrive on, depending on genetic inheritance. Traditional diets today include the vegetarian regimen of India's Jains, the meat-intensive fare of Inuit, and the fish-heavy diet of Malaysia's Bajau people. The Nochmani of the Nicobar Islands off the coast of India get by on protein from insects. “What makes us human is our ability to find a meal in virtually any environment,” says the Tsimane study co-leader Leonard.

Studies suggest that indigenous groups get into trouble when they abandon their traditional diets and active lifestyles for Western living. Diabetes was virtually unknown, for instance, among the Maya of Central America until the 1950s. As they've switched to a Western diet high in sugars, the rate of diabetes has skyrocketed. Siberian nomads such as the Evenk reindeer herders and the Yakut ate diets heavy in

fat or cholesterol. Our gut bacteria digest a nutrient in meat called L-carnitine. In one mouse study, digestion of L-carnitine boosted artery-clogging plaque. Research also has shown that the human immune system attacks a sugar in red meat that's called Neu5Gc, causing inflammation that's low level in the young but that eventually could cause cancer. “Red meat is great, if you want to live to 45,” says Ajit Varki of the University of California, San Diego, lead author of the Neu5Gc study.

Many paleoanthropologists say that although advocates of the modern Paleolithic diet urge us to stay away from unhealthy processed foods, the diet's heavy focus on meat doesn't replicate the diversity of foods that our ancestors ate—or take into account the active lifestyles that protected them from heart disease and diabetes. “What bothers a lot of paleoanthropologists is that we actually didn't have just one caveman diet,” says Leslie Aiello, president of the Wenner-Gren Foundation for Anthropological Research in New



York City. “The human diet goes back at least two million years. We had a lot of cavemen out there.”

In other words, there is no one ideal human diet. Aiello and Leonard say the real hallmark of being human isn’t our taste for meat but our ability to adapt to many habitats—and to be able to combine many different foods to create many healthy diets. Unfortunately the modern Western diet does not appear to be one of them.

THE LATEST CLUE as to why our modern diet may be making us sick comes from Harvard primatologist Richard Wrangham, who argues that the biggest revolution in the human diet came not when we started to eat meat but when we learned to cook. Our human ancestors who began cooking sometime between 1.8 million and 400,000 years ago probably had more children who thrived, Wrangham says. Pounding and heating food “predigests” it, so our guts spend less energy breaking it down, absorb more than if the food were raw, and thus extract more fuel for our brains. “Cooking produces soft, energy-rich foods,” says Wrangham. Today we can’t survive on raw, unprocessed food alone, he says. We have evolved to depend upon cooked food.

To test his ideas, Wrangham and his students fed raw and cooked food to rats and mice. When I visited Wrangham’s lab at Harvard, his then graduate student, Rachel Carmody, opened the door of a small refrigerator to show me plastic bags filled with meat and sweet potatoes, some raw and some cooked. Mice raised on cooked foods gained 15 to 40 percent more weight than mice raised only on raw food.

If Wrangham is right, cooking not only gave early humans the energy they needed to build bigger brains but also helped them get more calories from food so that they could gain weight. In the modern context the flip side of his hypothesis is that we may be victims of our own success. We have gotten so good at processing foods that for the first time in human evolution, many humans are getting more calories than they burn in a day. “Rough breads have given way to Twinkies, apples to apple juice,” he writes. “We need to become more aware of the calorie-

raising consequences of a highly processed diet.”

It’s this shift to processed foods, taking place all over the world, that’s contributing to a rising epidemic of obesity and related diseases. If most of the world ate more local fruits and vegetables, a little meat, fish, and some whole grains (as in the highly touted Mediterranean diet), and exercised an hour a day, that would be good news for our health—and for the planet.

ON MY LAST AFTERNOON visiting the Tsimane in Anachere, one of Deonicio Nate’s daughters, Albania, 13, tells us that her father and half-brother Alberto, 16, are back from hunting and that they’ve got something. We follow her to the cooking hut and smell the animals before we see them—three raccoonlike coatis have been laid across the fire, fur and all. As the fire singes the coatis’ striped pelts, Albania and her sister, Emiliana, 12, scrape off fur until the animals’ flesh is bare. Then they take the carcasses to a stream to clean and prepare them for roasting.

Nate’s wives are cleaning two armadillos as well, preparing to cook them in a stew with shredded plantains. Nate sits by the fire, describing a good day’s hunt. First he shot the armadillos as they napped by a stream. Then his dog spotted a pack of coatis and chased them, killing two as the rest darted up a tree. Alberto fired his shotgun but missed. He fired again and hit a coati. Three coatis and two armadillos were enough, so father and son packed up and headed home.

As family members enjoy the feast, I watch their little boy, Alfonso, who had been sick all week. He is dancing around the fire, happily chewing on a cooked piece of coati tail. Nate looks pleased. Tonight in Anachere, far from the diet debates, there is meat, and that is good. □

Science prevented the last food crisis. Can it save us again?

**COMING IN OCTOBER**

Supercrops help—but biotech alone can’t avert a food crisis.

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Her face dusted in *bedak sejuk*, a cooling powder made of rice and pandan leaves, Alpaيدا paddles out to visit friends in stilt houses. The teen and her family belong to the tribal group known as the Sea Bajau because they live year-round on their *lepa-lepa*, handmade houseboats.





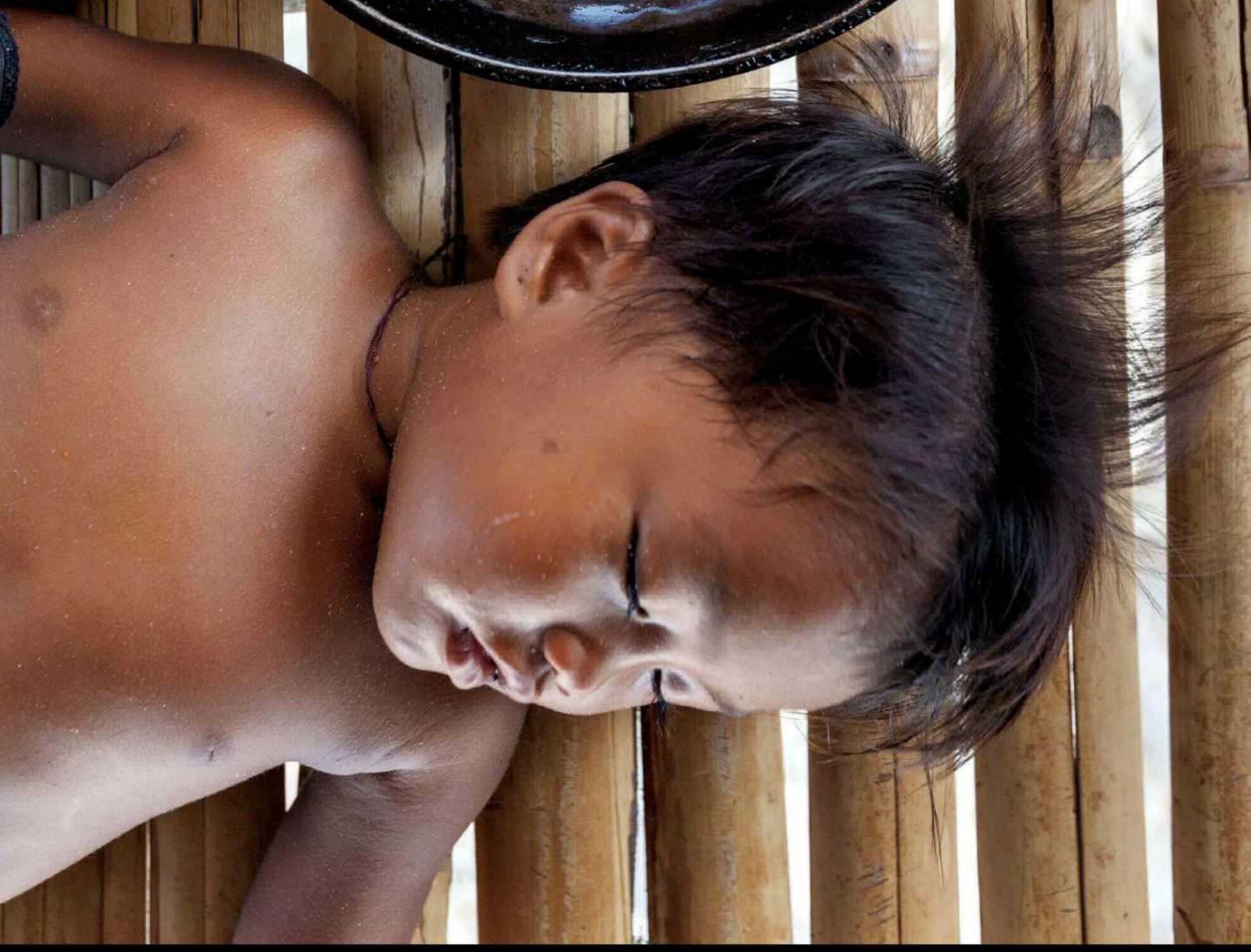
**The Bajau of Malaysia** fish and dive for almost everything they eat. Some live in houses on the beach or on stilts; others have no homes but their boats.





A Bajau fisherman clutches an octopus he speared after diving from his boat. Except for a dish made of ground cassava, all the Bajau's food comes from the sea. A Bajau baby (right) naps by a pan of abalone that will be his family's dinner.



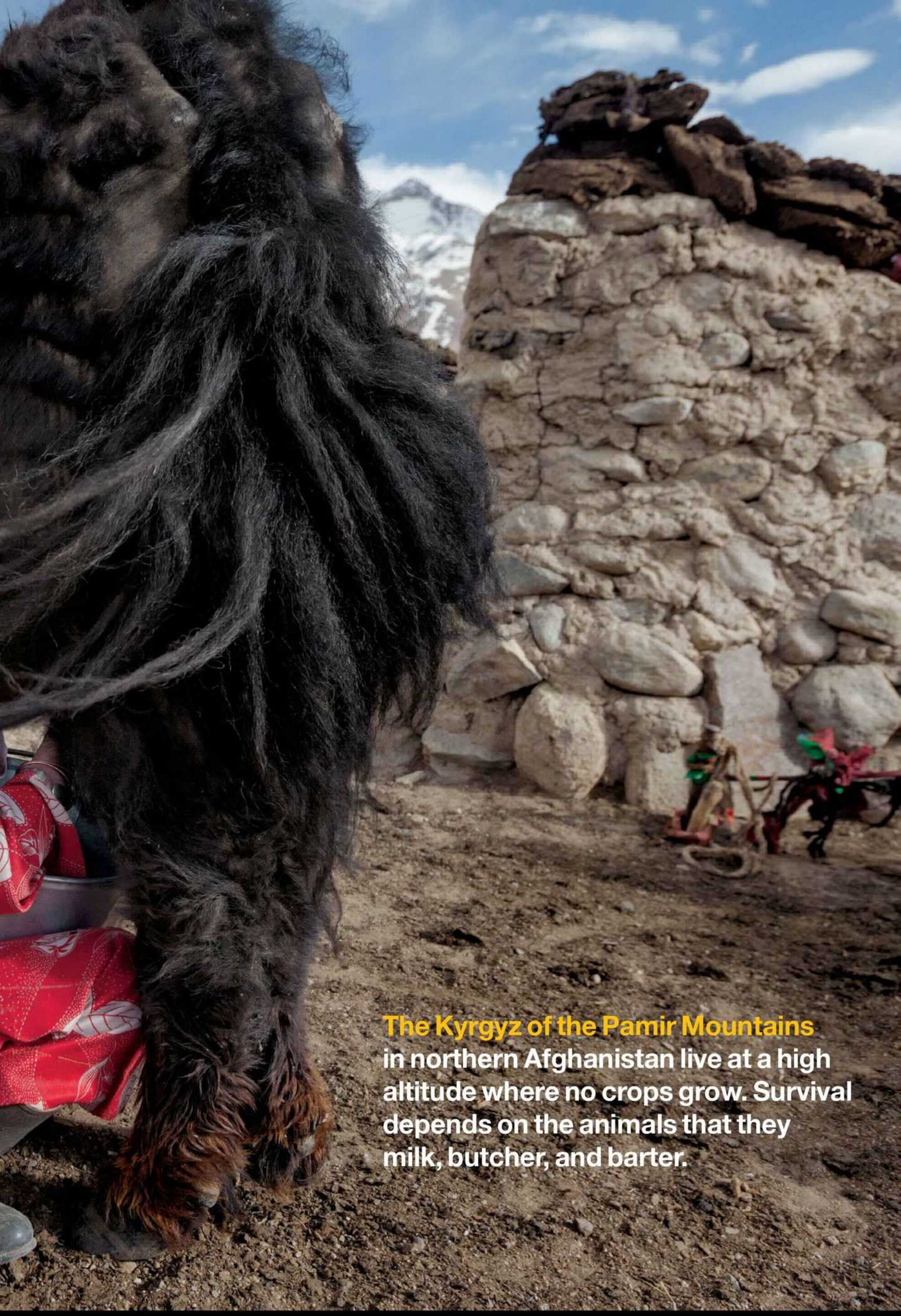




Ayeem Khan wears boots borrowed from her father and the red veil of an unmarried Kyrgyz girl, to be traded for a white one when she weds. Twice a day she milks the family's yaks; some milk curd will be dried for use in winter, when yaks give less.







**The Kyrgyz of the Pamir Mountains** in northern Afghanistan live at a high altitude where no crops grow. Survival depends on the animals that they milk, butcher, and barter.





A Kyrgyz woman strains milk with her hand, removing yak hair and other debris. Herders in the Shimshal Pamir, a remote part of northern Pakistan bordering China, tend their flocks (right). Yaks, goats, and sheep are fattened for months in summer pastures so that they can survive and provide food through the winter.









United States



Russia



Australia



Japan



## Field Rations Go Gourmet

If an army marches on its stomach, today's troops are walking tall. Field rations are more delicious, nutritious, and diverse than ever. In the U.S., meals ready to eat are developed at the Natick Soldier Systems Center. Food technologist Jeannette Kennedy says 30 million 1,300-calorie MREs—which can last 36 months at 80°F—are produced each year. In 1984, says retired Lt. Col. David Accetta, they were unvaried and unappetizing. The 24 tasty options today? “A huge improvement.”

PHOTO: ASHLEY GILBERTSON



Italy





United States



Russia



Australia



Japan



FULL-DAY RATIONS ARE SHOWN FOR SOME COUNTRIES, SINGLE MEALS FOR OTHERS. MEALS DEPICTED MAY NOT REPRESENT ENTIRE CONTENTS OF FIELD RATIONS.



FOOD

In Afghanistan one French field ration used to be worth six U.S. meals in a swap. Now, thanks to a much improved U.S. menu, that's reversed. Contents vary by country, but nutrition and nostalgia are universal. "MREs," says photographer Ashley Gilbertson, "are what home tastes like."

**United States** Includes items such as bread, Tabasco sauce, Skittles, Chiclets, spaghetti and meatballs, dried cranberries, pretzels, cheese spread

**Australia** Includes Scotch biscuits, chili con carne, tuna, a muesli cereal bar, diced pears, cheese, hard candy, Vegemite, a sesame-seed biscuit

**Russia** Includes meat with vegetables, instant noodles, stewed meat, instant dry milk, raisins, wheat crackers, chocolate, more stewed meat, whole sweetened condensed milk, instant buckwheat, black tea bags

**Japan** Includes cooked rice, seaweed, curry with vegetables and sausage

**Italy** Includes a mixed-fruit cup, portable stoves, jam, coffee, water-purification tablets and vitamins, biscuits, turkey, liqueur, toothbrushes, beef in gelatin, rice salad, pasta with beans, cereal bars



Italy



An aerial photograph of a rugged mountain range. The landscape is characterized by prominent, layered rock formations in shades of brown and tan, interspersed with patches of green vegetation. A winding river valley is visible on the right side of the image, cutting through the terrain. The overall scene is one of natural beauty and geological complexity.

**GILA WILDERNESS**

This was the precursor: Forty years before the Wilderness Act, 755,000 acres in New Mexico's Gila National Forest, including the Middle Fork of the Gila River, became the world's first designated wilderness.

50 Years of





# Wilderness

President Lyndon Johnson signed the Wilderness Act in 1964 to give future generations a “glimpse of the world as it was in the beginning.” Did it work?









**COLUMBINE-HONDO PROPOSED WILDERNESS**

Snow clings to aspens near Taos, New Mexico, in the Sangre de Cristo Mountains. A proposal to protect 45,000 acres here in the Carson National Forest is one of some 30 wilderness bills before Congress.



By Elizabeth Kolbert

Photographs by Michael Melford

**F**red Lavigne is looking for a tree. It's a beautifully clear day, with a sky the deep blue of delFTWARE. Though the calendar says early spring, in the Sandwich Range Wilderness in central New Hampshire there are still several feet of snow on the ground. A thin layer of ice coats the snow, making it sparkle underfoot.

We're surrounded by trees: towering spruces, scraggly beeches, maples, oaks, birches. But Lavigne, a sometime logger and full-time outdoorsman, is looking for one tree in particular. We've left the trail behind, and he's navigating the steep terrain by memory, on snowshoes. Finally he finds what he's been searching for, a red pine with a wide, sticky gash right at eye level. Plucking a coarse black hair from the frozen sap, Lavigne says that the gash was made by bears as a form of communication. (Though what exactly they're telling each other no one's quite sure.) Farther on we come to a dead beech with a much longer and fresher gash—the work of a pileated woodpecker. A bit beyond that, we reach a clearing.

"You see, nature does its own logging," Lavigne tells me. The gap was produced by the demise of an enormous spruce, which lies before us like a fallen giant. With a ski pole Lavigne points out some balsam fir seedlings that moose have nibbled on. We spend several more hours snowshoeing through the forest, mostly off the trail, and, as Lavigne happily observes, do not come across any other human footprints.

The Sandwich Range Wilderness isn't very big—just 55 square miles—and it's certainly not remote: Some 70 million people, including

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*Elizabeth Kolbert's most recent book is The Sixth Extinction. Michael Melford photographed New Zealand's jade country for the March issue.*

#### **WHITE CLOUDS PROPOSED WILDERNESS**

In the 1960s, opposition to a planned open-pit mine on Idaho's Castle Peak helped create the Sawtooth Wilderness (background). Castle Peak and the mountains nearby still await such permanent protection.



my own family, live within a day's drive. But for precisely these reasons, it's a good place to reflect on the legacy of the Wilderness Act, which turns 50 this year. As I follow Lavigne through the woods, I wonder what explains our enduring attachment to wilderness and what these days that term even means.

THE WILDERNESS ACT WAS signed into law by President Lyndon Johnson on September 3, 1964. But to understand the genesis of the act, you have to go back another three decades, to the 1930s. During the Great Depression tens of thousands of Americans were put to work by the federal government in national parks and forests. They cleared trails, erected shelters, and laid down mile after mile of pavement. The Going-to-the-Sun Road in Glacier National Park was opened in 1933, Skyline Drive in Shenandoah





National Park in 1939. The new highways opened up the parks to millions more visitors.

But the very success of these efforts troubled many conservationists, who worried that the country's most majestic landscapes were being turned into so many roadside attractions. A group of them, including Aldo Leopold, got together to defend the national parks and forests against overuse. They called themselves the Wilderness Society, and their first mission statement denounced the roadbuilding "craze."

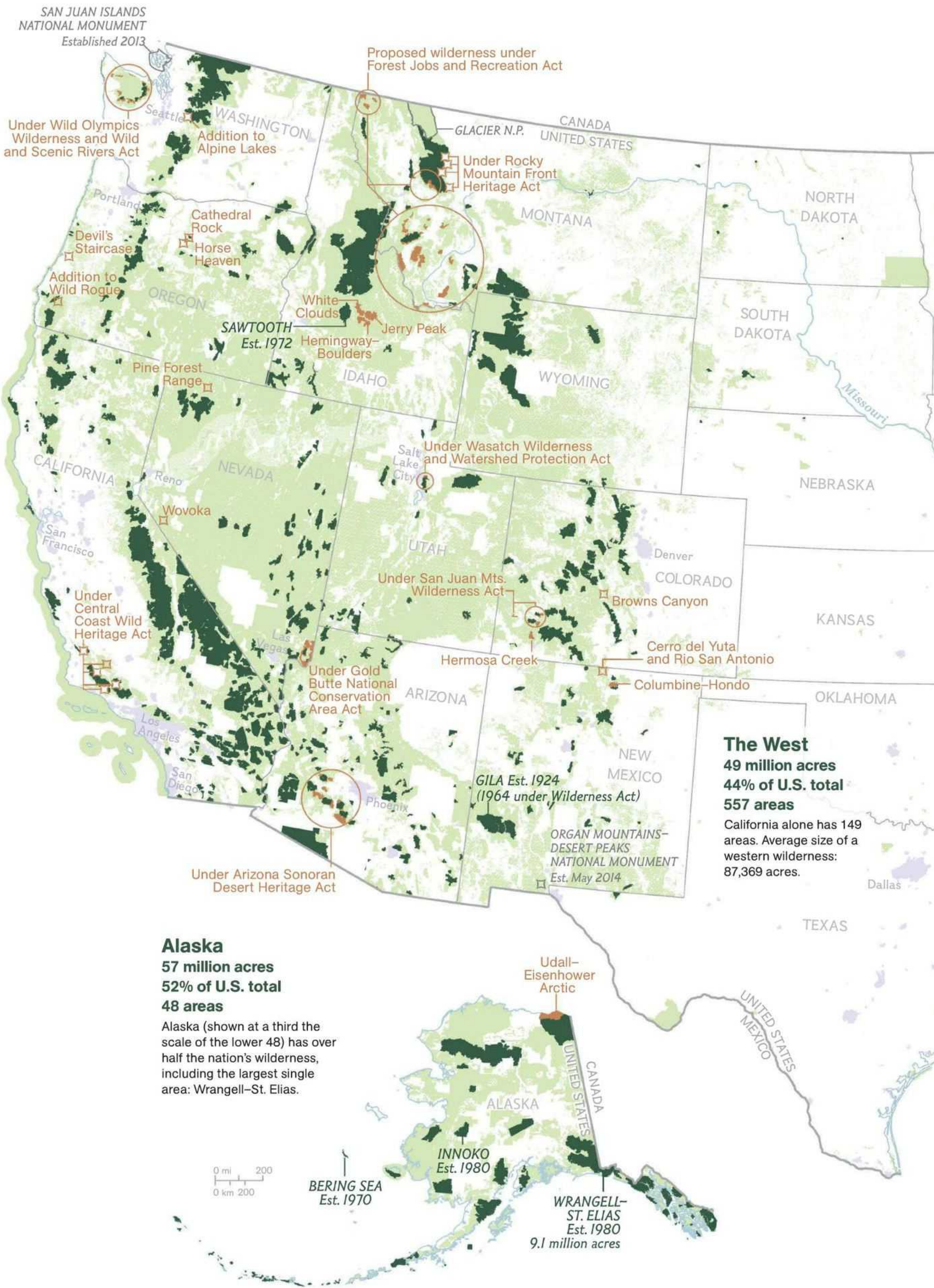
"The fashion is to barber and manicure wild America as smartly as the modern girl," it said. "Our duty is clear." In 1924, while working with the Forest Service in New Mexico, Leopold had persuaded his superiors to designate 755,000 acres of the Gila National Forest as roadless wilderness. The challenge was to persuade Congress to give that idea national scope.

The Wilderness Act went through more than 60 drafts before it finally passed. It created a new category of federal lands that could be overlaid on the old like a transparency on a map. Congress—and only Congress—could place land in the new category. Once designated as wilderness, a tract would be off-limits to commercial ventures like logging and new mines. It would be available for humans to explore, but not with mechanized vehicles. Horses and canoes are allowed; mountain bikes have been ruled out.

"A wilderness," the statute observed in surprisingly lyrical terms, is "an area where the earth and its community of life are untrammelled by man, where man himself is a visitor who does not remain." The 1964 act set aside 54 such areas.

"If future generations are to remember us with gratitude rather than contempt," President Johnson said after signing the act, then "we must





**SAN JUAN ISLANDS NATIONAL MONUMENT**  
Established 2013

Proposed wilderness under Forest Jobs and Recreation Act

Under Wild Olympics Wilderness and Wild and Scenic Rivers Act

WASHINGTON  
Addition to Alpine Lakes

GLACIER N.P. UNITED STATES

Under Rocky Mountain Front Heritage Act

PORTLAND  
Cathedral Rock  
Horse Heaven

MONTANA

NORTH DAKOTA

Devil's Staircase

OREGON

White Clouds

SOUTH DAKOTA

SAWTOOTH Est. 1972

Jerry Peak

IDAHO

WYOMING

Pine Forest Range

Hemingway-Boulders

Under Wasatch Wilderness and Watershed Protection Act

NEBRASKA

CALIFORNIA

RENO

NEVADA

UTAH

DENVER

Wovoka

Under San Juan Mts. Wilderness Act

COLORADO

KANSAS

Under Central Coast Wild Heritage Act

SAN FRANCISCO

Under Gold Butte National Conservation Area Act

HERMOSA CREEK

Cerro del Yuta and Rio San Antonio

Columbine-Hondo

OKLAHOMA

LOS ANGELES

ARIZONA

NEW MEXICO

**The West**  
49 million acres  
44% of U.S. total  
557 areas

California alone has 149 areas. Average size of a western wilderness: 87,369 acres.

Under Arizona Sonoran Desert Heritage Act

GILA Est. 1924 (1964 under Wilderness Act)

ORGAN MOUNTAINS-DESERT PEAKS NATIONAL MONUMENT Est. May 2014

**Alaska**  
57 million acres  
52% of U.S. total  
48 areas

Alaska (shown at a third the scale of the lower 48) has over half the nation's wilderness, including the largest single area: Wrangell-St. Elias.

Udall-Eisenhower Arctic

ALASKA

INNOKO Est. 1980

WRANGELL-ST. ELIAS Est. 1980  
9.1 million acres

0 mi 200  
0 km 200

BERING SEA Est. 1970

UNITED STATES  
MEXICO

CANADA  
UNITED STATES

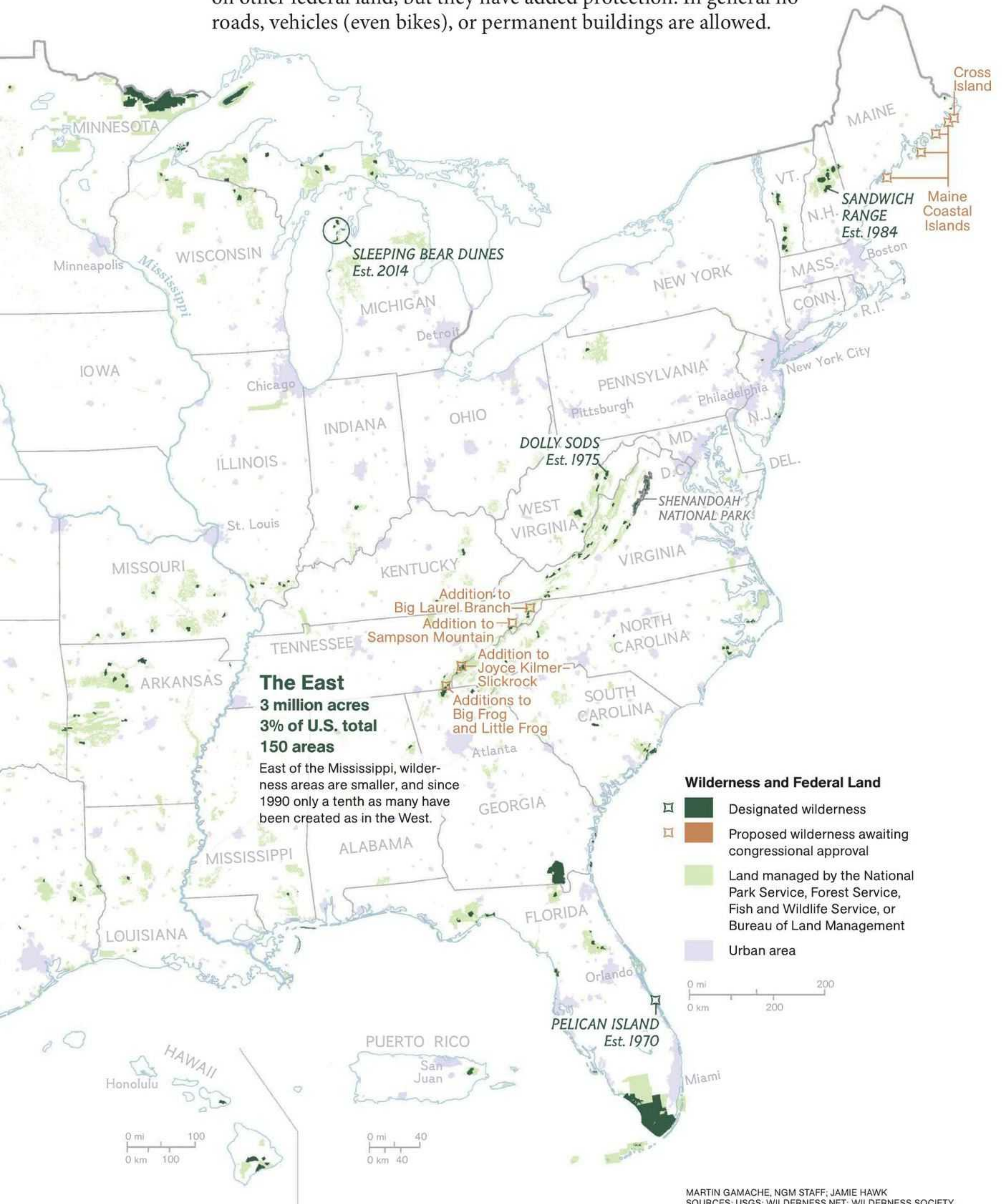
Dallas

TEXAS



# America's Wilderness Areas

There are 758 so far in 44 states, covering 5 percent of the U.S.—a total of 110 million acres. Wilderness areas are in national parks or on other federal land, but they have added protection: In general no roads, vehicles (even bikes), or permanent buildings are allowed.



MARTIN GAMACHE, NGM STAFF; JAMIE HAWK  
 SOURCES: USGS; WILDERNESS.NET; WILDERNESS SOCIETY





leave them a glimpse of the world as it was in the beginning, not just after we got through with it.”

SINCE JOHNSON SIGNED THE ACT, the number of wilderness areas has increased to more than 750. They range from the tiny Pelican Island Wilderness in central Florida, which is just 5.5 acres, to the immense Wrangell–St. Elias Wilderness, which at nearly 9.1 million acres is bigger than Belgium. All told, officially designated wilderness covers 5 percent of the U.S., an area larger than California. The newest wilderness area, part of Sleeping Bear Dunes National Lakeshore on Lake Michigan, was added just this past March.

Few, if any, of these areas are wild in any rigorous sense. They’re certainly not “untrammelled by man.” A visitor to the Sandwich Range in the late 19th century would have encountered a landscape very obviously shaped by humans.

Most of the slopes had been clear-cut for timber, and there were several working sawmills in the area; Lavigne pointed out where they’d once stood. To the extent that the place now appears wild, it’s because the forest has regrown.

And what goes for the Sandwich Range goes for pretty much every wilderness area east of the Mississippi; at various points they’ve all been logged or grazed or farmed or graded or some combination of these. (During World War II what’s now the Dolly Sods Wilderness in West Virginia was used for live artillery practice.) Most western landscapes have also been altered, if not by European settlers, then by the Native Americans they displaced.

“The myth of the wilderness as ‘virgin,’ uninhabited land had always been especially cruel when seen from the perspective of the Indians who had once called that land home,”





**SLEEPING BEAR  
DUNES WILDERNESS**

Last March, Congress invoked the Wilderness Act for the first time in five years, designating 32,500 acres of the Sleeping Bear Dunes National Lakeshore on the east side of Lake Michigan. Some of the dunes tower more than 400 feet above the lake.

the environmental historian William Cronon has observed.

“In truth, ‘Wilderness’ is a state of mind and heart” is how photographer Ansel Adams once put it. “Very little exists now in actuality.”

Today even the most remote wilderness areas, like the Bering Sea Wilderness off Alaska or the Innoko Wilderness in the state’s interior, are being dramatically altered by the grand geophysical experiment that humans are conducting. Sea ice is disappearing, permafrost is thawing, and woody plants are invading the tundra, all thanks to global warming. The impossibility of escaping human influence, even in those few parts of the globe that people have never inhabited, has led some scientists to propose that we are living in a new geologic epoch, the Anthropocene.

In the age of man the Wilderness Act may seem futile—but it has arguably become more

important. Designating land as wilderness represents an act of humility. It acknowledges that the world still transcends our comprehension, and its value, the use we can make of it.

“I look at wilderness today as the control in the grand experiment,” says Garry Oye, just retired as chief of wilderness stewardship for the National Park Service. “Throughout time we’ve demonstrated that we really don’t understand natural systems. Having these blocks of land protected as wilderness shows some restraint.”

There are practical as well as ethical arguments for such restraint. In the Anthropocene many—perhaps most—species are on the move, tracking the changing climate. Plants and animals that find their routes blocked by cities or airports or highways are likely to be in trouble. Wilderness areas, which allow for less impeded movement, may provide the best hope for new plant and animal communities to form.


“The reason designated wilderness is so important is because it legislatively and permanently sets aside big pieces of land,” says Peter Landres, an ecologist at the Aldo Leopold Wilderness Research Institute in Missoula, Montana. “These big pieces are needed to let ecological and evolutionary processes play out. So if I’m an animal and I don’t like it here, I can move over there. Yes, wilderness is affected by climate change, but it’s exactly because our world is now so dominated by people that it’s so important to have places where we let nature be.”

And defining wilderness loosely, as land that’s relatively untrammelled, opens lots of places to the designation. Fifteen years ago Fred Lavigne led a successful campaign to add 10,000 acres to the Sandwich Range Wilderness; that increased the size of the wilderness by 40 percent, which means 40 percent more room for bears and moose and woodpeckers to move around. Some 30 proposed wilderness areas now await approval from a gridlocked Congress. None of the proposals would have made it even that far without broad local support. There would be no better way to celebrate the Wilderness Act’s golden anniversary than for Washington to approve them. □



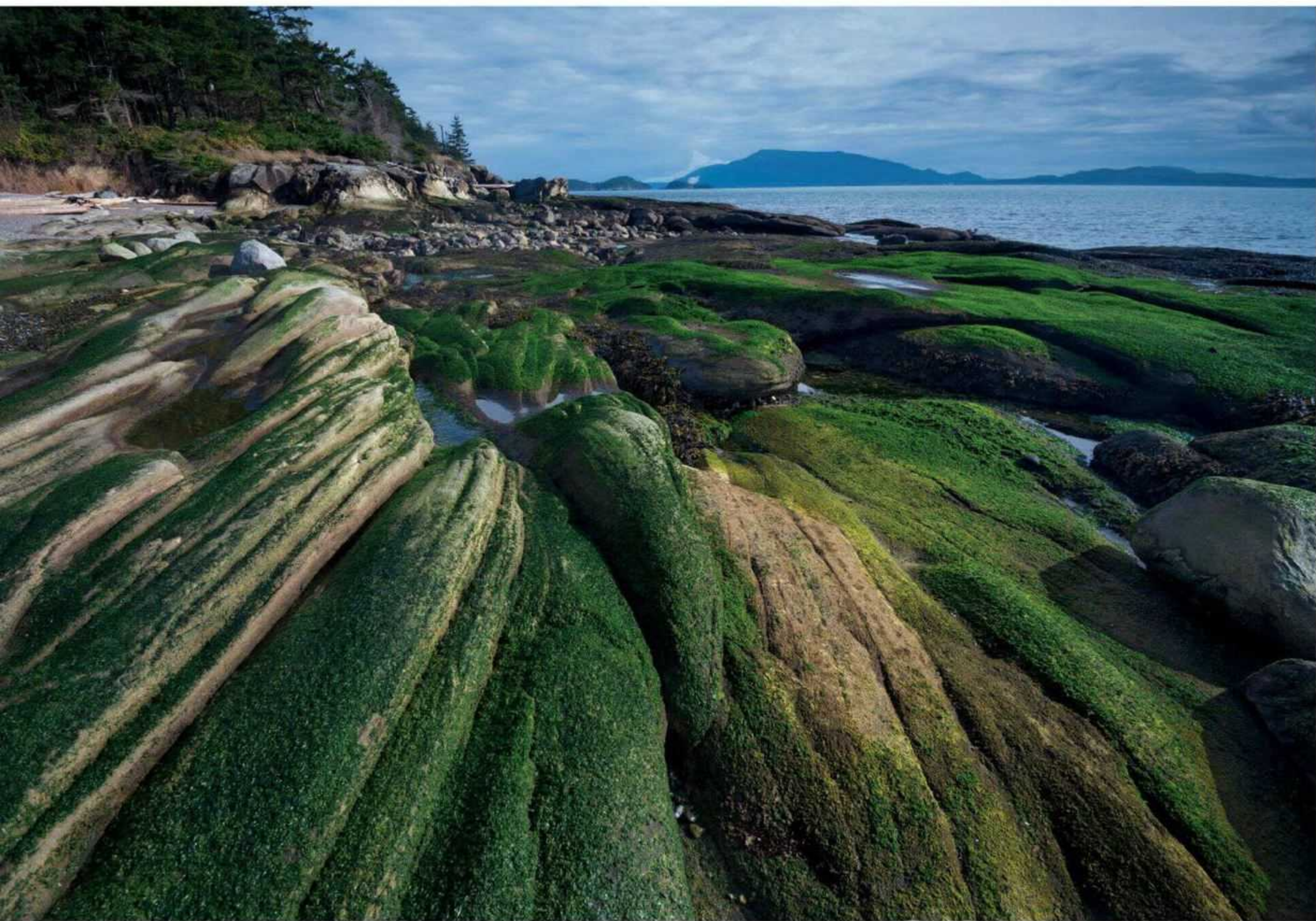




An aerial photograph of a vast mountain range in Montana during the "blue hour" of dawn. The scene is dominated by rugged, snow-covered peaks and ridges. The low sun casts a soft, golden light across the landscape, highlighting the textures of the snow and the dark, forested valleys. The sky is a mix of deep blues and purples, with wispy clouds catching the light. The overall mood is serene and majestic.

**ROCKY MOUNTAIN FRONT PROPOSED WILDERNESS**  
Day breaks on the Front Range in Montana. The mountains and plains in this region shelter a rich collection of plants and wildlife, including grizzly bears.





**SAN JUAN ISLANDS**

Patos Island, Washington, is part of a thousand-acre national monument created last year by President Barack Obama. Wilderness, a higher form of land protection, covers 350 acres of the San Juans—but only Congress can designate a wilderness.





**ORGAN MOUNTAINS-DESERT PEAKS  
NATIONAL MONUMENT**

Soaptree yuccas soak up morning light in southern New Mexico. "I am not finished," the president said in May, as he created this newest national monument. "I'm searching for more opportunities."



HE KILLED TWO  
OF HIS WIVES  
AND POSSIBLY  
HIS MOTHER.  
HE MAY HAVE  
PRESIDED OVER  
THE BURNING OF  
ROME. BUT HE  
NEVER FIDDLED,  
AND NOW SOME  
SCHOLARS SAY HE  
WASN'T ALL BAD.

BY ROBERT DRAPER

PHOTOGRAPHS BY RICHARD BARNES  
AND ALEX MAJOLI





# RETHINKING NERO

NERONE

A statue of Nero resides in Anzio, Italy, his hometown.

RICHARD BARNES





Nero's successors largely buried his legacy from view. Beneath the Oppian Hill (at left) the remains of his palace are closed to the public. By contrast, the Colosseum receives more than 10,000 visitors a day.

RICHARD BARNES









At the Vista Club near the Oppian Hill, entertainer Doctor Vintage performs for a late-night audience. Nero was a showman too, who sang and played the lyre. His nocturnal carousing in the streets of Rome was well documented and condemned by contemporary biographers.

ALEX MAJOLI









A painting depicts Rome in flames on July 18, A.D. 64.

"THE FIRE OF ROME," CA 1770-1790, BY HUBERT ROBERT, MUSÉE ANDRÉ MALRAUX, ERICH LESSING, ART RESOURCE





## UNDERNEATH ROME'S OPPIAN HILL,

today a modest public park marred by unclever graffiti, where young men idly kick around a soccer ball, elderly couples walk their dogs, and transients build charcoal fires, part of the greatest palace in the history of the Eternal City lies buried.

The palace is called the *Domus Aurea*, or Golden House, erected by and for Nero. When the 30-year-old emperor's crazed world exploded in A.D. 68, and he ordered a subject to drive a knife through his throat, gasping, so they say, "What an artist dies in me," his palace may not even have been completed. The next few emperors reconfigured or ignored it, and in 104 Trajan reused the palace's walls and vaults to create a suitable foundation for his famous baths. For the next 1,400 years the entombed palace was utterly forgotten.

Around 1480 a few excavators began digging on the Oppian Hill and found what they thought were the ruins of the Baths of Titus. One of them fell through the dirt, landed in a pile of rubble, and found himself looking up at a ceiling still covered in sumptuous frescoes. Word spread across Italy. Great artists of the Renaissance—Raphael, Pinturicchio, Giovanni da Udine—climbed down into the hole to study (and later replicate in palaces and the Vatican) the repetitive ornamental motifs that would eventually be termed grotesques, after the grotto-like conditions of the *Domus*. More digging begat more wonderment: long, colonnaded hallways overlooking what had been a vast park and artificial lake; traces of gold and shards of marble quarried from Egypt and the Middle East that once covered the walls and vaulted ceilings; and a magnificent octagonal room with a domed roof, constructed fully six decades before the completion of Hadrian's exalted Pantheon.



Today, following the partial collapse of its roof in 2010, the Domus Aurea is closed to the public until further notice. Staff show up daily to tend to the frescoes and patch the leaks, their cult-like labors unseen by the park's pedestrians 25 feet overhead. Until he recently retired, a Roman architect named Luciano Marchetti oversaw the activity at the Golden House. One morning Marchetti stood in the chilly underground darkness of the octagonal room at the eastern end of the palace complex. Holding a flashlight, he gazed up at the vaulted, eight-sided ceiling, 50 feet from one corner to the next, externally buttressed by the arches of adjacent rooms and thereby hovering without visible support, like a UFO.

"I'm so moved by this," he said quietly as he pointed to the self-sustaining flat arches over the doorways. "This is an architectural sophistication that had never been seen before. The Pantheon is marvelous, of course. But its dome sits on a cylinder, which they built up brick by brick. This dome is held up by structures you don't see."

Sighing, the architect then muttered a Latin phrase: *Damnatio memoriae*. Canceled from memory—the fate of the palace as well as the accomplishments of its owner.

To the immediate southwest of this wing of the Domus Aurea, just across an ever humming Roman boulevard and directly on top of where Nero's artificial lake had been, sits the Colosseum. The world-famous amphitheater, built by Vespasian in the years following Nero's suicide, was apparently named for the more than 100-foot-tall bronze statue of Nero depicted as the sun god—the Colossus Neronis—that once loomed over the valley. Today the Colosseum receives upwards of 10,000 visitors each day. The PR-savvy shoe manufacturer Diego Della Valle has donated \$34 million toward its refurbishment. From the Colosseum's ticket sales, a small stream flows to fund the

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*Robert Draper is a contributing writer with the magazine. To visually capture Rome, Richard Barnes photographed the ancient architecture and Alex Majoli depicted modern-day life.*

ongoing restoration of the dank and shuttered palace across the street.

Just to the west of the Colosseum sprawl the lavish imperial ruins on the Palatine Hill. In April 2011 the Special Superintendency for the Archaeological Heritage of Rome opened an exhibit at the Palatine and other locations nearby devoted to the life and works of Nero. On display for the first time were the monster king's many architectural and cultural contributions; also unveiled, on the grounds of the Palatine itself, was a recently excavated chamber believed by many to be Nero's famed *coenatio rotunda*, a rotating dining hall with sweeping views onto the Alban Hills. The exhibitors knew that any show about the notorious Nero would attract visitors. They had not anticipated a turnout greater than any since the superintendency hosted its first exhibit a decade before.

"Well, he's good box office," observes Roberto Gervaso, the bald and hawk-eyed 77-year-old author of the 1978 biographical novel *Nerone*. "They've made lots of films about Nero, but they couldn't resist making a caricature of him. There's no need to do that—he himself was a bit of a caricature anyway. Such picturesque depravity attracts a biographer. I could never write a biography of St. Francis! And I would certainly rather go to dinner with Nero than Hadrian."

Tonight Gervaso is stuck with me for a dining companion. We sit outside, just a hundred yards from the slumbering Domus Aurea, at Osteria da Nerone, one of the few structures in Rome that bear the emperor's name. "The restaurant is always full," says Gervaso, insisting there's a connection. "He was a monster. But that's not all he was. And those who came before and after him were no better. The true monsters, like Hitler and Stalin, lacked [Nero's] imagination. Even today he would be avant-garde, ahead of his time.

"I wrote my book 35 years ago precisely because I wanted to rehabilitate him. Maybe you could do more."

WELL. ONE IS HARD PRESSED to "rehabilitate" a man who, according to historical accounts, ordered his first wife, Octavia, killed; kicked



his second wife, Poppaea, to death when she was pregnant; saw to the murder of his mother, Agrippina the Younger (possibly after sleeping with her); perhaps also murdered his stepbrother, Britannicus; instructed his mentor Seneca to commit suicide (which he solemnly did); castrated and then married a teenage boy; presided over the wholesale arson of Rome in A.D. 64 and then shifted the blame to a host of Christians (including Saints Peter and Paul), who were rounded up and beheaded or crucified and set

comic Ettore Petrolini's Nero as babbling lunatic, Peter Ustinov's Nero as the cowardly murderer, and the garishly enduring tableau of Nero fiddling while Rome burns. What occurred over time was hardly erasure but instead demonization. A ruler of baffling complexity was now simply a beast.

"Today we condemn his behavior," says archaeological journalist Marisa Ranieri Panetta. "But look at the great Christian emperor Constantine. He had his first son, his second wife,



**"HE WAS A MONSTER. BUT THAT'S NOT ALL HE WAS ... EVEN TODAY HE WOULD BE AVANT-GARDE, AHEAD OF HIS TIME."**

—ROBERTO GERVASO

afire so as to illuminate an imperial festival. The case against Nero as evil incarnate would appear to be open and shut. And yet...

Almost certainly the Roman Senate ordered the expunging of Neronian influence for political reasons. Perhaps it was that his death was followed by outpourings of public grief so widespread that his successor Otho hastily renamed himself Otho Nero. Perhaps it was because mourners long continued to bring flowers to his tomb, and the site was said to be haunted until, in 1099, a church was erected on top of his remains in the Piazza del Popolo. Or perhaps it was due to the sightings of "false Neros" and the persistent belief that the boy king would one day return to the people who so loved him.

The dead do not write their own history. Nero's first two biographers, Suetonius and Tacitus, had ties to the elite Senate and would memorialize his reign with lavish contempt. The notion of Nero's return took on malevolent overtones in Christian literature, with Isaiah's warning of the coming Antichrist: "He will descend from his firmament in the form of a man, a king of iniquity, a murderer of his mother." Later would come the melodramatic condemnations: the

and his father-in-law all murdered. One can't be a saint and the other a devil. Look at Augustus, who destroyed a ruling class with his blacklists. Rome ran in rivers of blood, but Augustus was able to launch effective propaganda for everything he did. He understood the media. And so Augustus was great, they say. Not to suggest that Nero was himself a great emperor—but that he was better than they said he was, and no worse than those who came before and after him."

Ranieri Panetta is among the energetic and multiplying voices who have spurred a reappraisal of Nero. Not everyone is on board. "This rehabilitation—this process of a small group of historians trying to transform aristocrats into gentlemen—seems quite stupid to me," says the famed Roman archaeologist Andrea Carandini. "For instance, there are serious scholars who now say that the fire was not Nero's fault. But how could he build the Domus Aurea without the fire? Explain that to me. Whether or not he started the fire, he certainly profited from it."

It's worth lingering on Carandini's logic—Nero benefited from the fire, therefore he caused the fire—since the horrific blaze that damaged or destroyed 10 of Rome's 14 regions is central to Neronian mythology. (Continued on page 99)



Workers restore the Octagonal Room in Nero's Domus Aurea palace, where the emperor likely hosted dinners. All surfaces would have been lavishly decorated. Pieces of blue, green, and white glass found in excavation may have lined the dome as twinkling mosaics.

RICHARD BARNES  
MINISTRY OF CULTURE, SPECIAL  
SUPERINTENDENCY FOR THE  
ARCHAEOLOGICAL HERITAGE OF ROME









# GRAND AMBITION

## 1 Circus Maximus

In A.D. 64 a fire broke out at Rome's largest stadium. It raged through the city for nine days.

## 2 Palatine Hill

Imperial residences were situated here from about 30 B.C. to the time of Constantine, in the fourth century A.D.

## 3 Man-made lake

This boating venue was drained shortly after Nero's death to make way for the amphitheater now called the Colosseum.

Tiber River

2

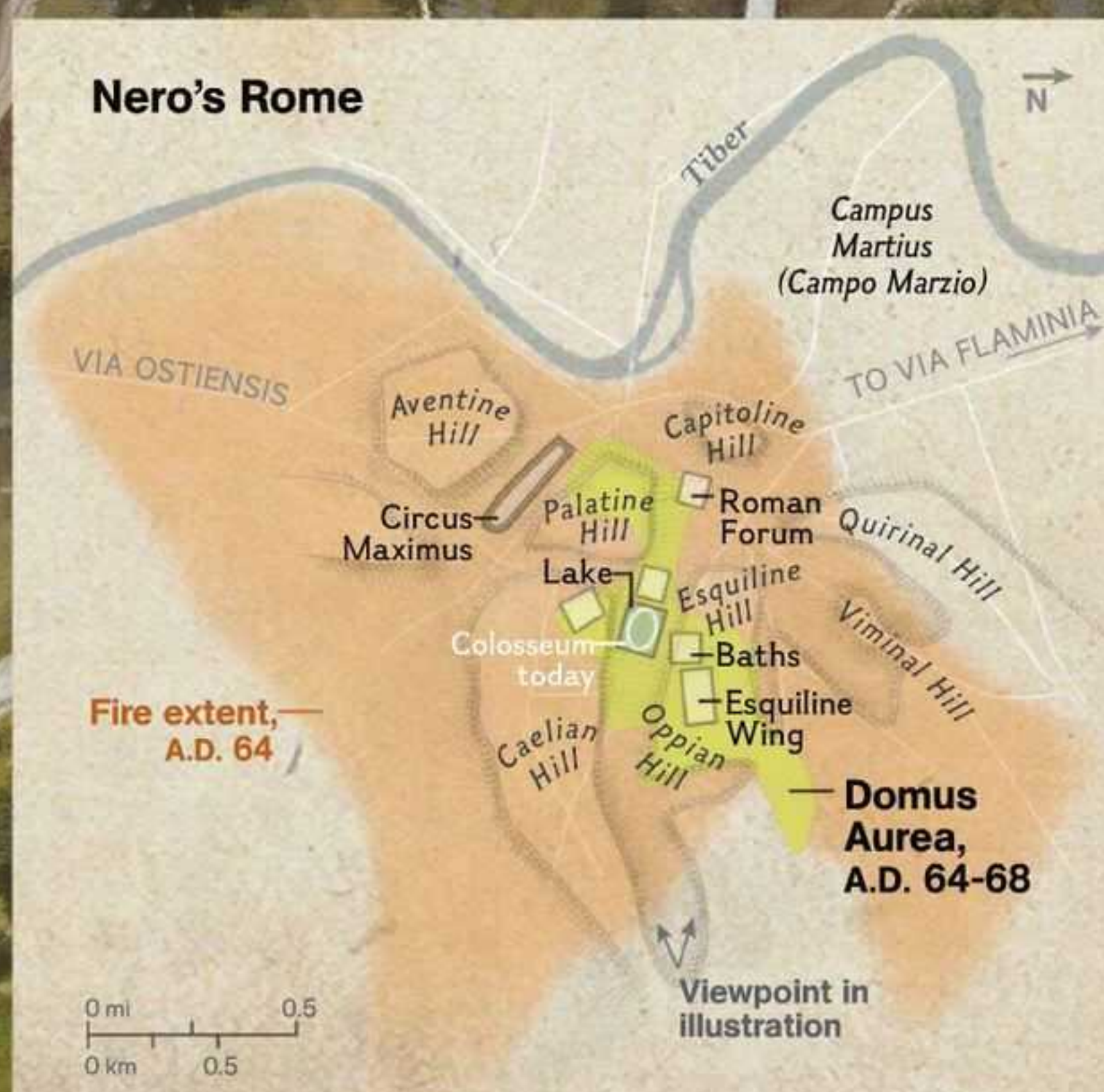
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### Colosseum

Named for the Colossus of Nero, the arena became a symbol of the empire.



See an animated graphic on our digital editions.



Nero built his extravagant new palace—the Domus Aurea, or Golden House—as a reflection of his own magnificence. Replacing perhaps hundreds of acres of urban sprawl destroyed by fire, the palace grounds included buildings, landscaped woods and gardens, and a large artificial lake.

**4 Palace entrance**

A monumental bronze statue of Nero was created for the courtyard that served as the palace's entryway.

**5 Entertainment rooms**

The imperial retreat had more than 150 lavishly decorated rooms, including one with an unusual octagon shape.

**6 Public areas**

Ordinary Romans could visit the palace grounds, where wild and domesticated animals wandered freely.



Roman Forum

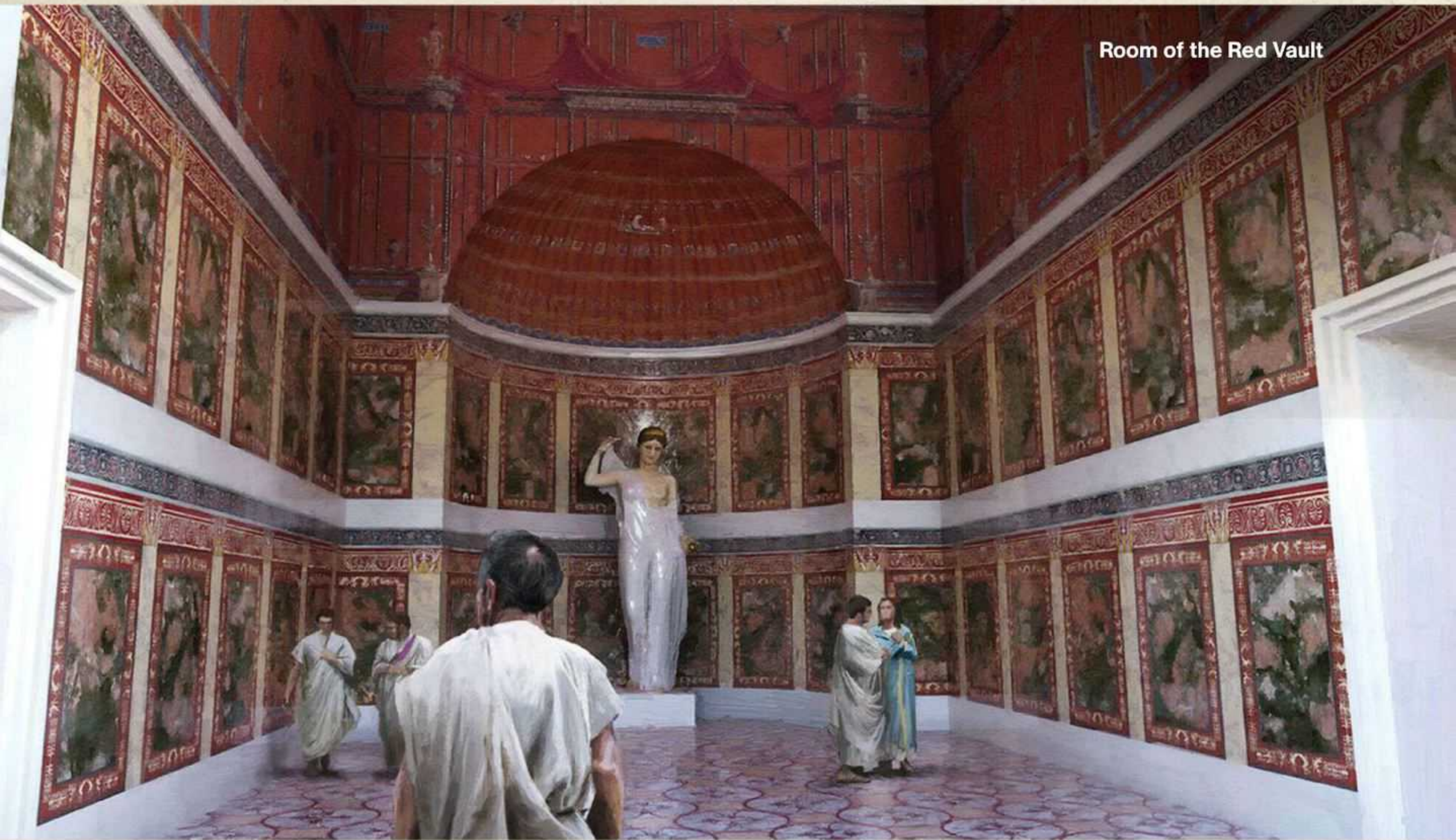
Baths

Octagonal Room

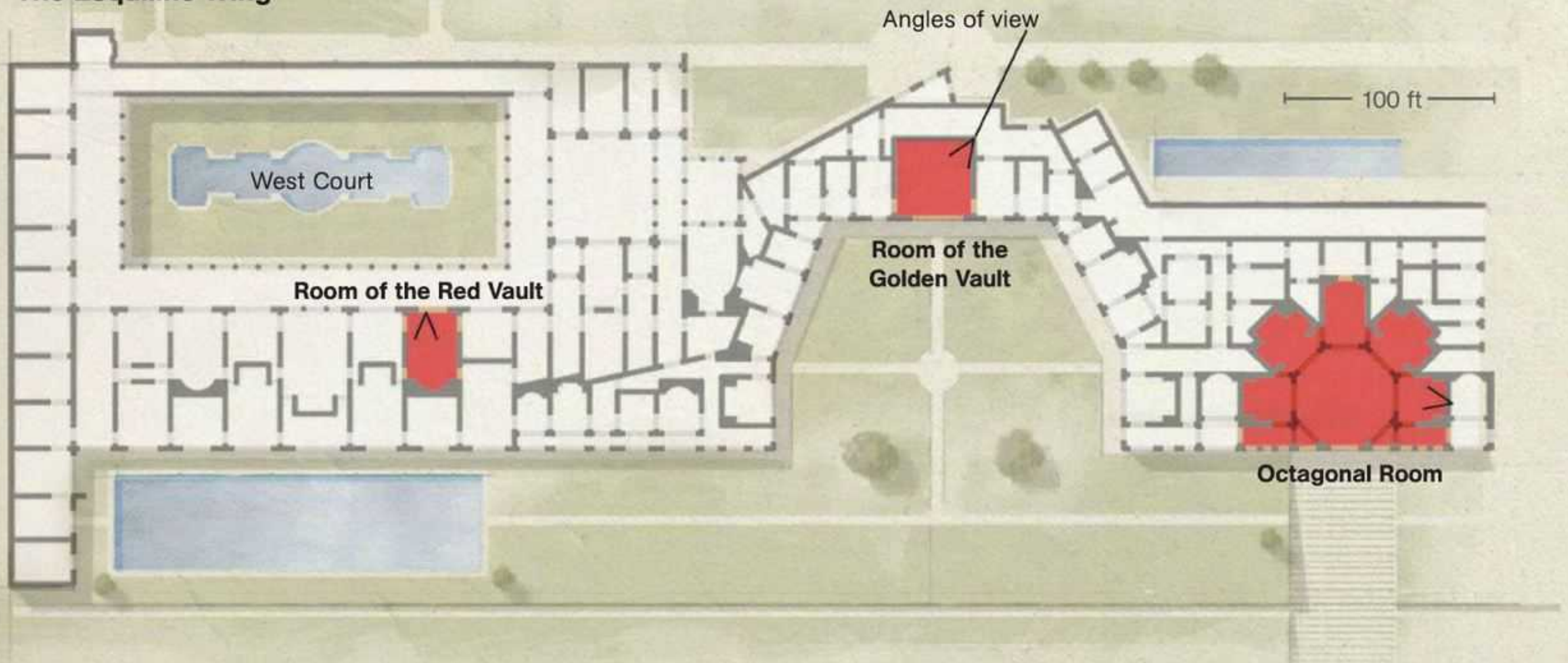
Esquiline Wing  
Rooms shown on  
the next page



# THE DOMUS AUREA



## The Esquiline Wing



### Room of the Red Vault

Experts believe this chamber may have served as an art gallery. The two-foot-square brick base found in the apse likely supported a statue.

### Room of the Golden Vault

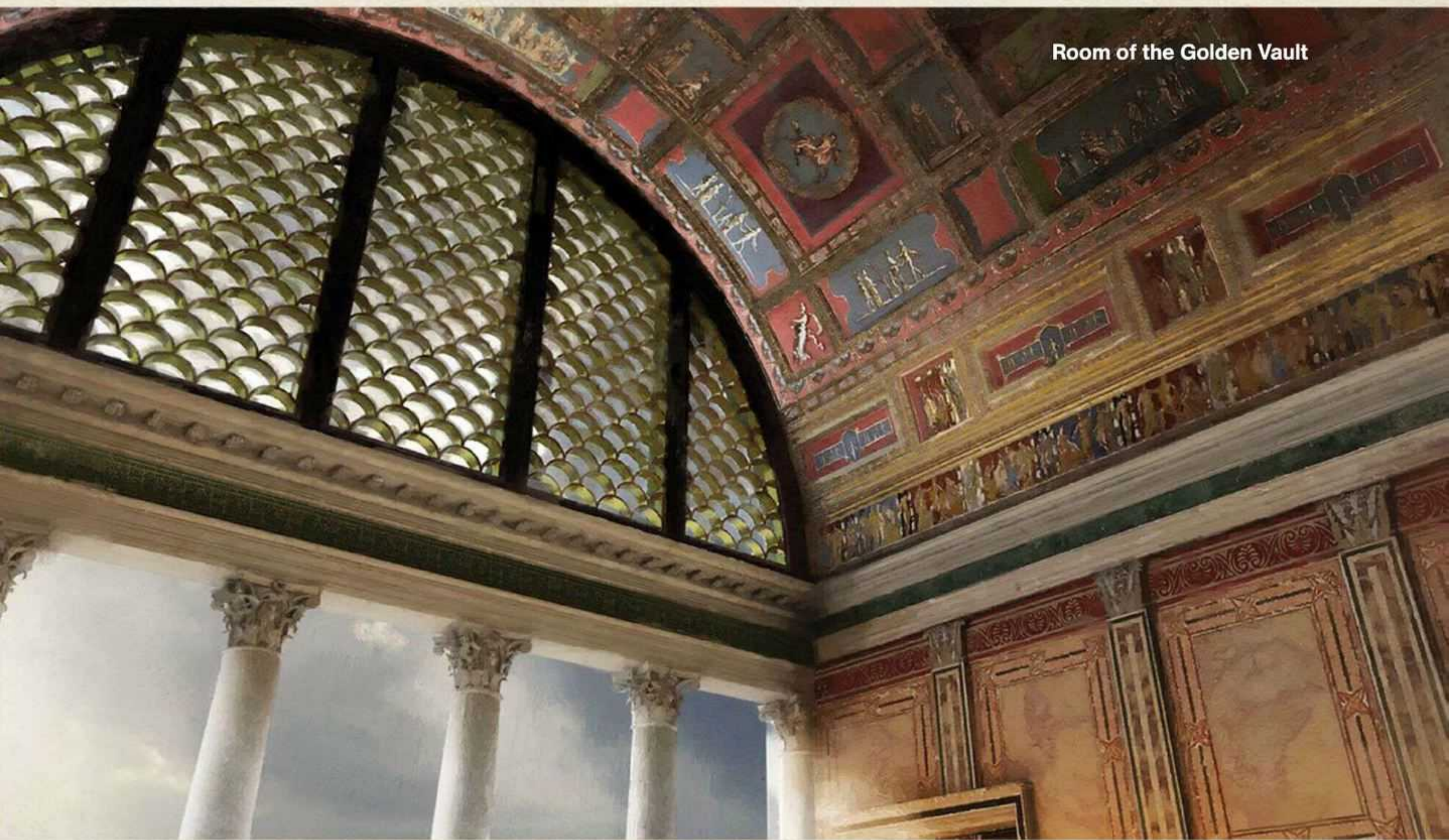
Traces of gilded plaster gave this room its modern name. The frescoes discovered here and in other rooms inspired Renaissance painters.

### Octagonal Room

This unique hall was open to the sky. Its decoration included marble from around the Mediterranean—a symbol of Nero's far-reaching power.



By the time Nero began to build his villa, Roman architects had mastered the technical aspects of working with concrete. This allowed them to construct wide, soaring vaults—part of an innovative design of light-filled rooms. These re-creations offer glimpses of what the villa might have looked like in all its glory.



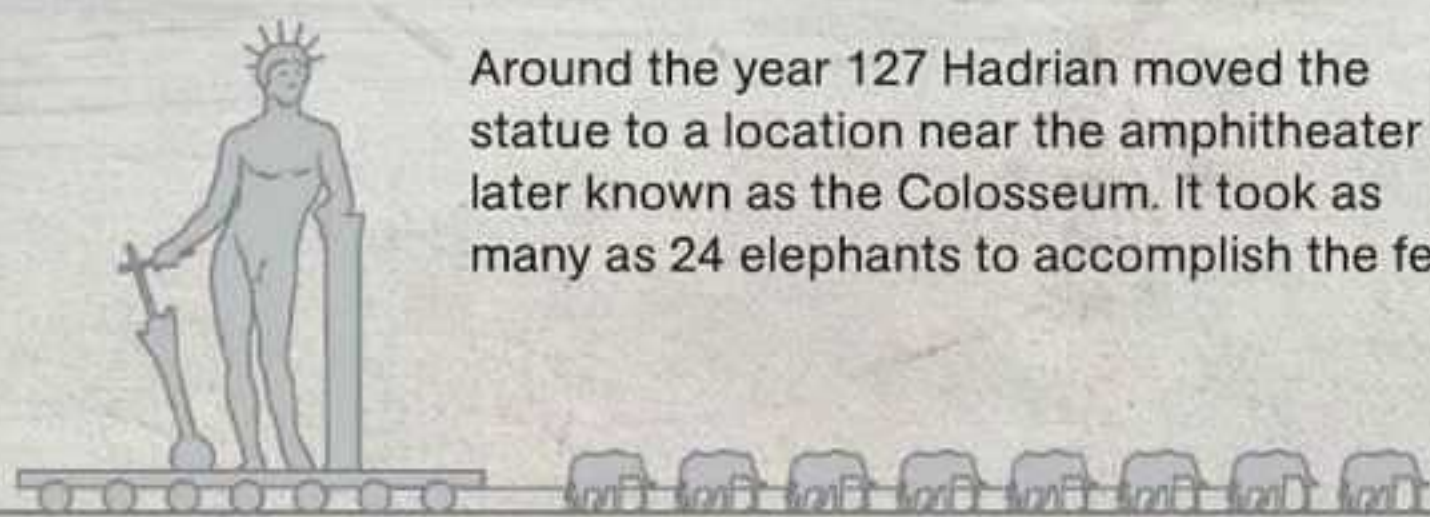
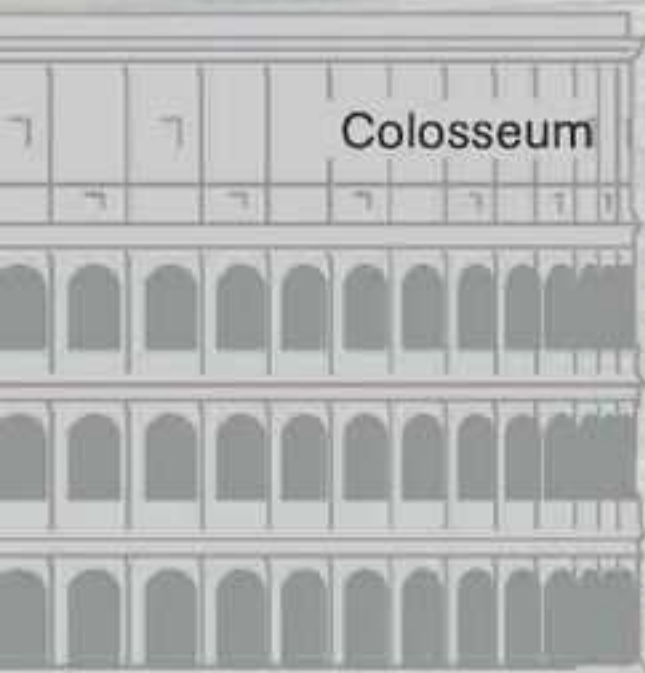
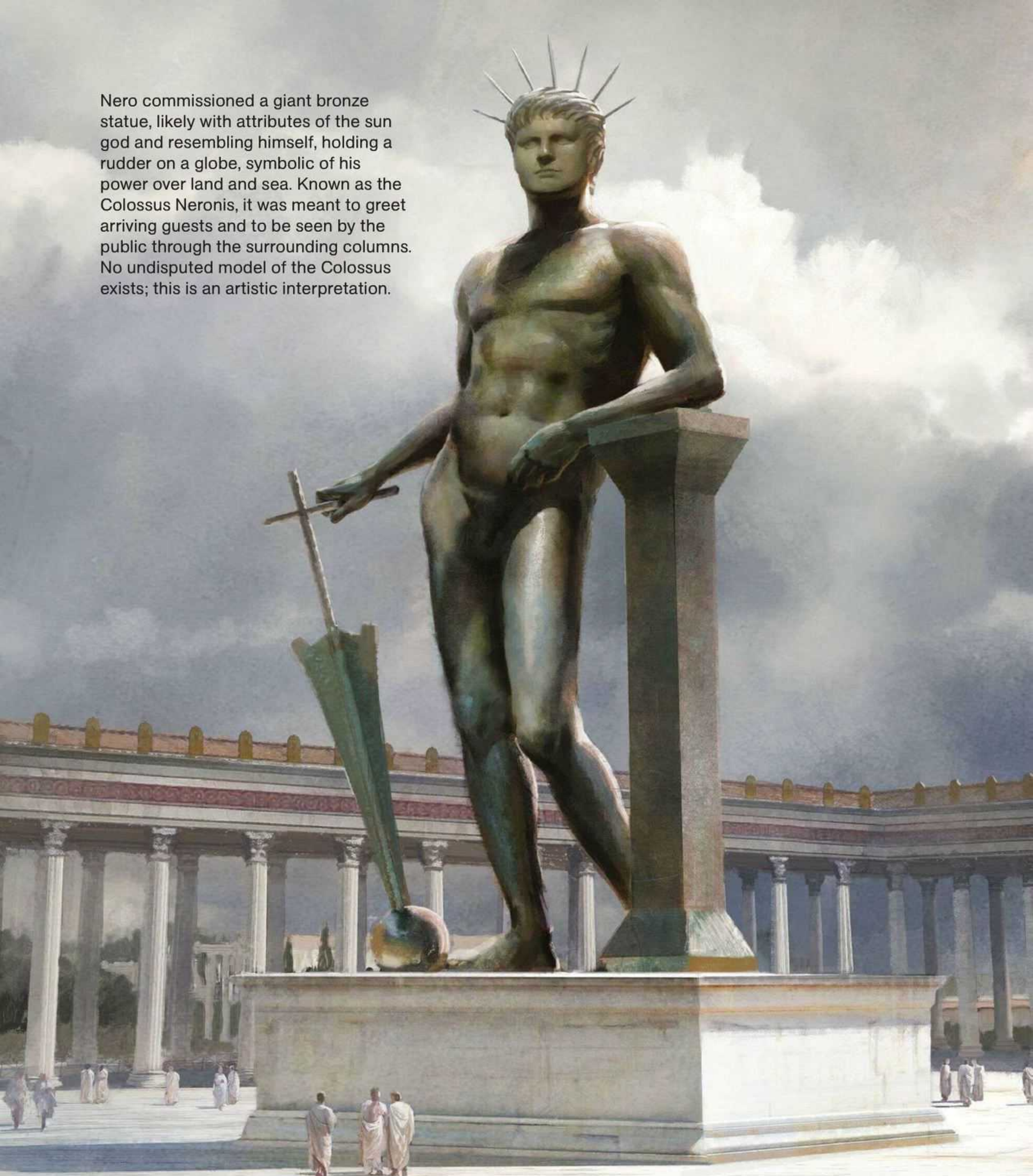
Room of the Golden Vault



Octagonal Room

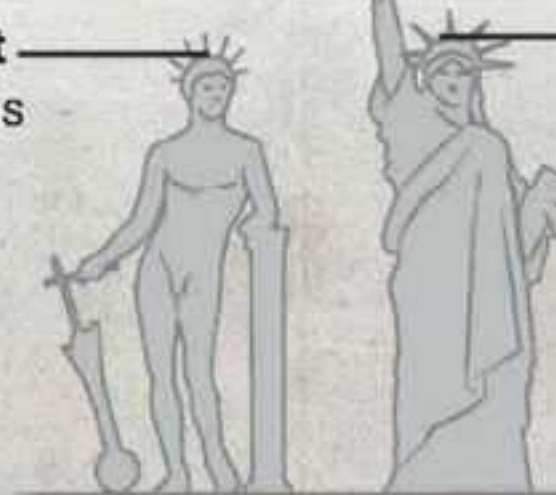


Nero commissioned a giant bronze statue, likely with attributes of the sun god and resembling himself, holding a rudder on a globe, symbolic of his power over land and sea. Known as the Colossus Neronis, it was meant to greet arriving guests and to be seen by the public through the surrounding columns. No undisputed model of the Colossus exists; this is an artistic interpretation.



Around the year 127 Hadrian moved the statue to a location near the amphitheater later known as the Colosseum. It took as many as 24 elephants to accomplish the feat.

103 feet  
Colossus  
of Nero



111 feet  
Statue  
of Liberty



“Even Tacitus, the great accuser of Nero, writes that no one knows whether Rome burned from arson or by chance,” counters Ranieri Panetta. “Rome in Nero’s time had very narrow streets” and was full of tall buildings with wooden upper stories. “Fire was essential for lighting, cooking, and heating. Consequently almost all the emperors had big fires during their reigns.” It also happens that Nero was not in Rome when the Great Fire began, but instead in his birthplace of Antium, modern-day Anzio. At some point during the conflagration, he sped back to Rome, and while it seems the case that Nero did enjoy playing a stringed instrument known as the kithara, the first account alleging that he did so while watching flames consume the city was written by Cassius Dio a century and a half after the fact. Tacitus, who lived during the time of Nero, wrote that the emperor ordered the homeless to be sheltered, offered cash incentives to those who could expeditiously rebuild the city, and instituted and enforced fire safety codes...

... And rounded up, condemned, and crucified the then hated Christians. And seized the charred remains of the Eternal City as the future site of his Golden House. “He lent himself to the label of monster,” Ranieri Panetta concedes. “He was an easy target.”

“WHAT WORSE THAN NERO?” wrote the poet Martial, a contemporary of the emperor. But then came his next line: “What better than Nero’s baths?”

In 2007, while conducting impact studies for a new subway line that would plow through the heart of the city, a Roman archaeologist with the Italian Ministry of Culture named Fedora Filippi was digging directly under the busy Corso Vittorio Emanuele II when she discovered the base of a column. Burrowing further, beneath a Mussolini-era building along Piazza Navona, Filippi encountered a portico—and nearby, the edge of a pool. It took more than a year of stratigraphic analysis and poring over historical texts before she concluded that she had discovered the enormous public gymnasium built by Nero a few years before the Great Fire of 64. Plans

for the metro stop at the site were immediately abandoned, as were the excavations. Outside of academia, Filippi’s important discovery received little attention.

“The gymnasium was part of a big change Nero brought about in Rome,” Filippi says. “He introduced the concept of Greek culture—and with it, this idea of physical and intellectual education of youth, and soon it spread throughout the empire. Before, such baths were only for the aristocrats. This changed social relations, because it put everyone on the same level, from senators to the horsemen.”

Nero was a grenade hurled into an already untidy social order. Despite blood connections with Augustus on both his maternal and paternal sides, he seemed anything but Roman: blond, blue-eyed, and freckle-faced, with an appetite for art rather than war. His sly and ambitious mother, Agrippina, was accused of plotting to kill her brother Caligula and later probably killed her third husband, Claudius, with poisonous mushrooms. Having already arranged for the stoic essayist Seneca to mentor her young son, Agrippina proclaimed Nero a worthy successor to the throne, and in A.D. 54, just shy of age 17, he assumed it. Anyone curious about the mother’s intentions could find the answer on coins from the era, depicting the teenage emperor’s face no larger than that of Agrippina.

Nero’s early reign was golden. He banished Claudius’s secret trials, issued pardons, and when asked for his signature on a death warrant, moaned, “How I wish I had never learned to write!” He held working dinners with poets—perhaps, it would be theorized, so that he could steal their lines—and rigorously practiced his lyre as well as singing, though his voice was not the best. “Above all, he was obsessed with a desire for popularity,” wrote his biographer Suetonius, but Princeton classics professor Edward Champlin views Nero’s persona with more nuance. In his revisionist book, *Nero*, Champlin describes his subject as “an indefatigable artist and performer who happened also to be emperor of Rome” and “a public relations man ahead of his time with a shrewd understanding of what



the people wanted, often before they knew it themselves.” Nero introduced, for instance, the “Neronia”—Olympic-style poetry, music, and athletic contests. But what pleased the masses did not always please the Roman elites. When Nero insisted that senators compete along with commoners in other public games, his golden age began to crackle with tension.

“It was something new, like young people today with their social media, where suddenly everything personal is on exhibit,” says archaeologist Heinz-Jürgen Beste. “Nero was an artist, like Warhol and Lichtenstein, who embodied these changes. Like his baths—and what Martial said about them—this is the polarity of Nero. He’d created something no one had seen before: a light-flooded public place not just for hygiene but also where there were statues and paintings and books, where you could hang out and listen to someone read poetry aloud. It meant an entirely new social situation.”

In addition to the Gymnasium Neronis, the young emperor’s public building works included an amphitheater, a meat market, and a proposed canal that would connect Naples to Rome’s seaport at Ostia so as to bypass the unpredictable sea currents and ensure safe passage of the city’s food supply. Such undertakings cost money, which Roman emperors typically procured by raiding other countries. But Nero’s warless reign foreclosed this option. (Indeed, he had liberated Greece, declaring that the Greeks’ cultural contributions excused them from having to pay taxes to the empire.) Instead he elected to soak the rich with property taxes—and in the case of his great shipping canal, to seize their land altogether. The Senate refused to let him do so. Nero did what he could to circumvent the senators—“He would create these fake cases to bring some rich guy to trial and extract some heavy fine from him,” says Beste—but Nero was fast making enemies. One of them was his mother, Agrippina, who resented her loss of influence and therefore may have schemed to install her stepson, Britannicus, as the rightful heir to the throne. Another was his adviser Seneca, who was allegedly involved in a plot to kill Nero.

By A.D. 65, mother, stepbrother, and consigliere had all been killed.

Nero was free to be Nero. Thus ended the so-called good years of his reign, followed by years in which, as Oxford historian Miriam Griffin writes, “Nero escaped more and more into a world of fantasy,” until reality crashed down upon him.

SPENDING TIME IN THE still great but recession-battered city of Rome and discussing the last of the Julio-Claudian emperors with scholars and political figures, one is tempted to compare the grandiosity of Nero to the showmanship of a more recent fallen Italian leader.

“Nero was a fool and a megalomaniac, but a fool can also be charming and interesting,” says Andrea Carandini. “The thing he invented, which all demagogues after him repeated, was that he cherished the masses. He made a gigantic thing of inviting the whole city inside his Domus Aurea, which was one-third of the city, and making a gigantic show. This is television! And Silvio Berlusconi did exactly the same thing, using the media to connect with the plebes.”

The former mayor of Rome and Italy’s former minister of culture and the environment, Walter Veltroni, rejects any comparison between Nero and the scandal-ridden former prime minister, on the grounds that the latter thoroughly lacked Nero’s cultural appetites. “Berlusconi had no interest in archaeology—the word was simply not in his head,” says Veltroni (who, it should be said, also ran for prime minister but was defeated by Berlusconi in 2008). By contrast, he says, “for me, Nero’s Domus Aurea is the most beautiful place in the city—the most mysterious, where different periods of history weave together. When I was minister of culture in the late 1990s, I took Martin Scorsese to see it, who was so impressed with the grotesques. And I also took Ian McEwan into it—he wrote about the Domus Aurea in his novel *Saturday*.”

The entire palace complex was laid out like a stage, with woodlands and lakes and promenades accessible to all. Still, acknowledges Nero revisionist Ranieri Panetta, “it was a scandal,



because there was so much Rome for one person. It wasn't only that it was luxurious—there had been palaces all over Rome for centuries. It was the sheer size of it. There was graffiti: 'Romans, there's no more room for you, you have to go to [the nearby village of] Veio.' For all its openness, what the Domus ultimately expressed was one man's limitless power, right down to the materials used to construct it. "The idea of using so much marble was not just a show of wealth," says Irene Bragantini, an expert on

when the manager offered to take me downstairs to the wine cellar. Surrounding the racks of Barolos and Chiantis were stone remnants of an ancient structure. I later mentioned this to archaeologist Filippi. She said of this enduring swath of Rome, "Everything under that area is Campo Marzio, a part of the city where Nero was constructing." Discovering it would be left to chance—the lot of subway-line diggers and basement remodelers. Otherwise the full architectural greatness of Nero's reign would stay



## “HE WANTED TO BE CLOSE TO THE PEOPLE—BUT AS THEIR GOD, NOT AS THEIR FRIEND.”

—ALESSANDRO VISCOGLIOSI

Roman paintings. "All of this colored marble came from the rest of the empire—from Asia Minor and Africa and Greece. The idea is that you're controlling not just the people but also their resources. In my reconstruction, what happened in Nero's time is that for the first time, there's a big gap between the middle and upper class, because only the emperor has the power to give you marble."

A paradox began to define the reign of Nero. He had become the entertainer in chief, yet increasingly imperial in the process. "As he separated himself from the Senate and tried to move closer to the people, he was concentrating his power like an Egyptian pharaoh," says Ranieri Panetta. But an emperor could get only so close. "He was completely isolated in a bubble, and you had to go through a million layers to get to him," says Beste.

"He wanted to be close to the people," says professor of Greek and Roman architecture Alessandro Viscogliosi, who has designed a remarkable 3-D computerized reconstruction of the Domus Aurea. "But as their god, not as their friend."

ONE EVENING I WAS ENJOYING a meal at a palatial *enoteca* near Piazza Navona called Casa Blevé

buried beneath centuries of Roman history. Even in the mountain village of Subiaco, where Nero began building his audacious villa in A.D. 54—damming the Aniene River to create three lakes beneath his patio—the ruins repose behind a locked gate, unnoticed by the hordes of tourists who walk right past it en route to a nearby Benedictine monastery.

In all of the former empire, there is one locale that has elected to celebrate Nero: Anzio, the famed beachhead for American troops in World War II. This is where Nero was born and where he kept another villa—now mostly underwater, though numerous artifacts from the complex are housed at the local museum. In 2009 Anzio's new mayor, Luciano Bruschini, declared his intentions to commission a statue of the town's infamous native son. The statue was unveiled in 2010. Today it sits at the edge of the sea, a rather stunning representation of the emperor in his early 20s, well over six feet tall, standing in his toga on a pillar, his eyes intent as his extended right arm points toward the water in all its splendid mystery. The plaque gives his full ruling name in Italian—Nerone Claudio Cesare Augusto Germanico—and memorializes his birth here in Anzio on (Continued on page 110)





Villa Oplontis may have been a residence of the Poppaeae, the family of Poppaea Sabina, Nero's second wife and true love. He kicked her to death in A.D. 65, while she was pregnant—an act seen as evidence of his madness.

RICHARD BARNES  
MINISTRY OF CULTURE, SPECIAL  
SUPERINTENDENCY FOR THE  
ARCHAEOLOGICAL HERITAGE OF  
NAPLES AND POMPEI









## ROMAN RE

Living life flamboyantly is an attribute of Rome. A couple (top left) kisses at a party. Milo (who starred in Federico Fellini's *La Strada*) on the same streets where Nero himself lived. Well-heeled Romans—*i ricchi*—attend

ALEX MAJOLI (ALL)





# JEWELRY

associated with Nero—and with today's nightclub. Eighty-one-year-old actress Sandra (film *8½*) poses for paparazzi (bottom left) self was known to preen and mingle. And a high-society birthday party (below).









Nero was a populist with a fondness for spectacle that lives on in fighter Alessio "Legionarius" Sakara, elaborately tattooed with symbols of the Roman Empire. The Stadio dei Marmi (top left), a Mussolini-era complex, hosts tennis matches. Tourists and locals gather at the Piazza del Popolo (bottom left), where Nero is thought to have been buried.

ALEX MAJOLI (ALL)





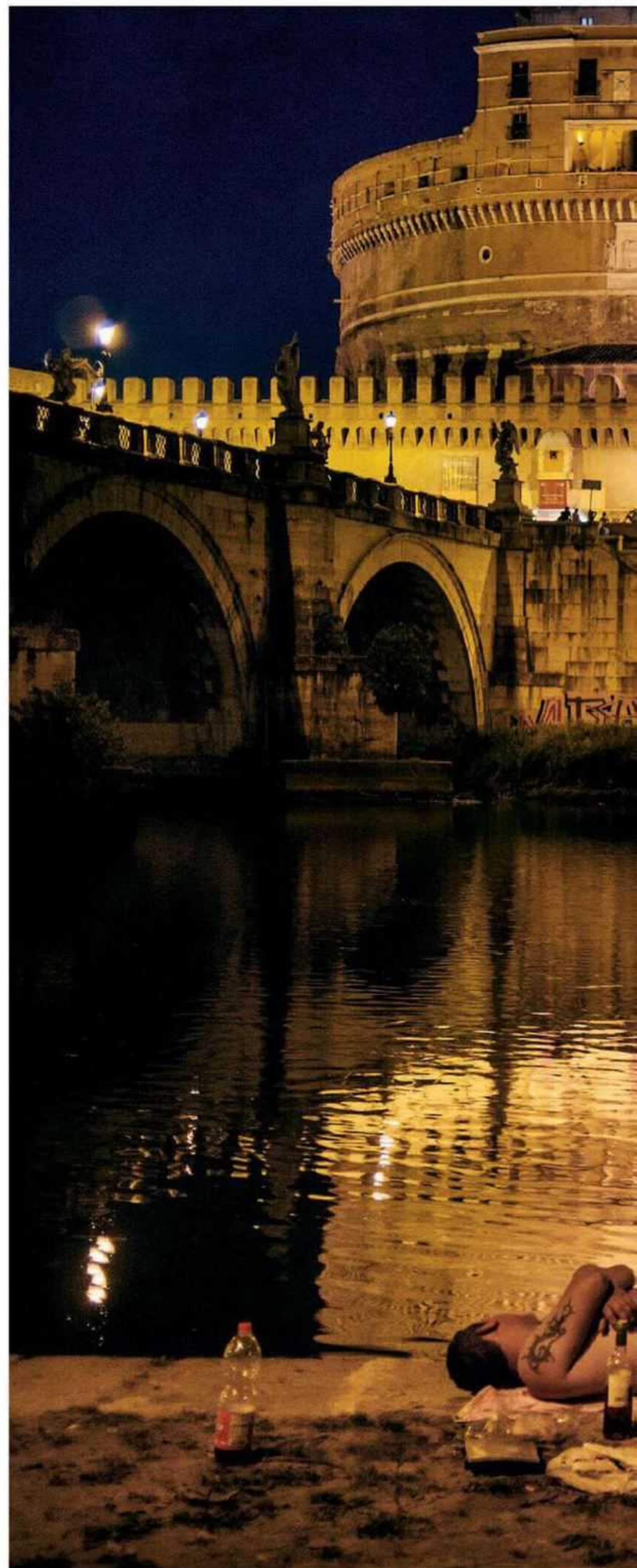
December 15, A.D. 37. Then, after describing his lineage, it says: “During his reign the empire enjoyed a period of peace, of great splendor, and of important reforms.”

“When I was a boy, I used to swim among the ruins of the villa,” Mayor Bruschini told me one spring morning as we sat in his office overlooking the sea. “As children, we were taught that he was evil—among the worst emperors of all. Doing a little research, I came to conclude that it’s not true. I consider Nero to be a good, even great emperor, and maybe the most beloved of the entire empire. He was a great reformer. The senators were rich, and they owned slaves. He took from them and gave to the poor. He was the first socialist!”

A proud socialist himself, Bruschini smiled and went on, “After I was elected, I decided to do this rehabilitation of Nero. We put up posters that said: ‘Anzio, City of Nero.’ Some people said, ‘But Mayor, he killed lots of Christians.’ I told them, ‘Only a few—nothing like the thousands of Christians who were killed later in the empire.’ We received proposals from two different sculptors. One of them portrayed Nero as a lunatic. We got rid of that one and used this other artist, which is the statue you see today. It’s now the most photographed place in the city. In summer big crowds congregate.”

Sometimes, the mayor told me, he would take a stroll out to the statue and listen to what the tourists were saying. Now and then, he would hear them read the plaque—“of peace, of great splendor, and of important reforms”—and mutter to themselves, “What a bunch of BS.” Myth-believers to the end, Bruschini would conclude, the same who believed that foolishness about fiddling while Rome burned and who would fail to appreciate the tragedy of Nero’s final day: a beleaguered ruler now in flight, persuaded by traitors to retreat not to Anzio or Egypt but instead to a villa north of Rome, pursued by enemies and distraught with the knowledge that the only choice left was his manner of death.

No matter. The boy king was home now in Anzio, surrounded by the masses once again. □



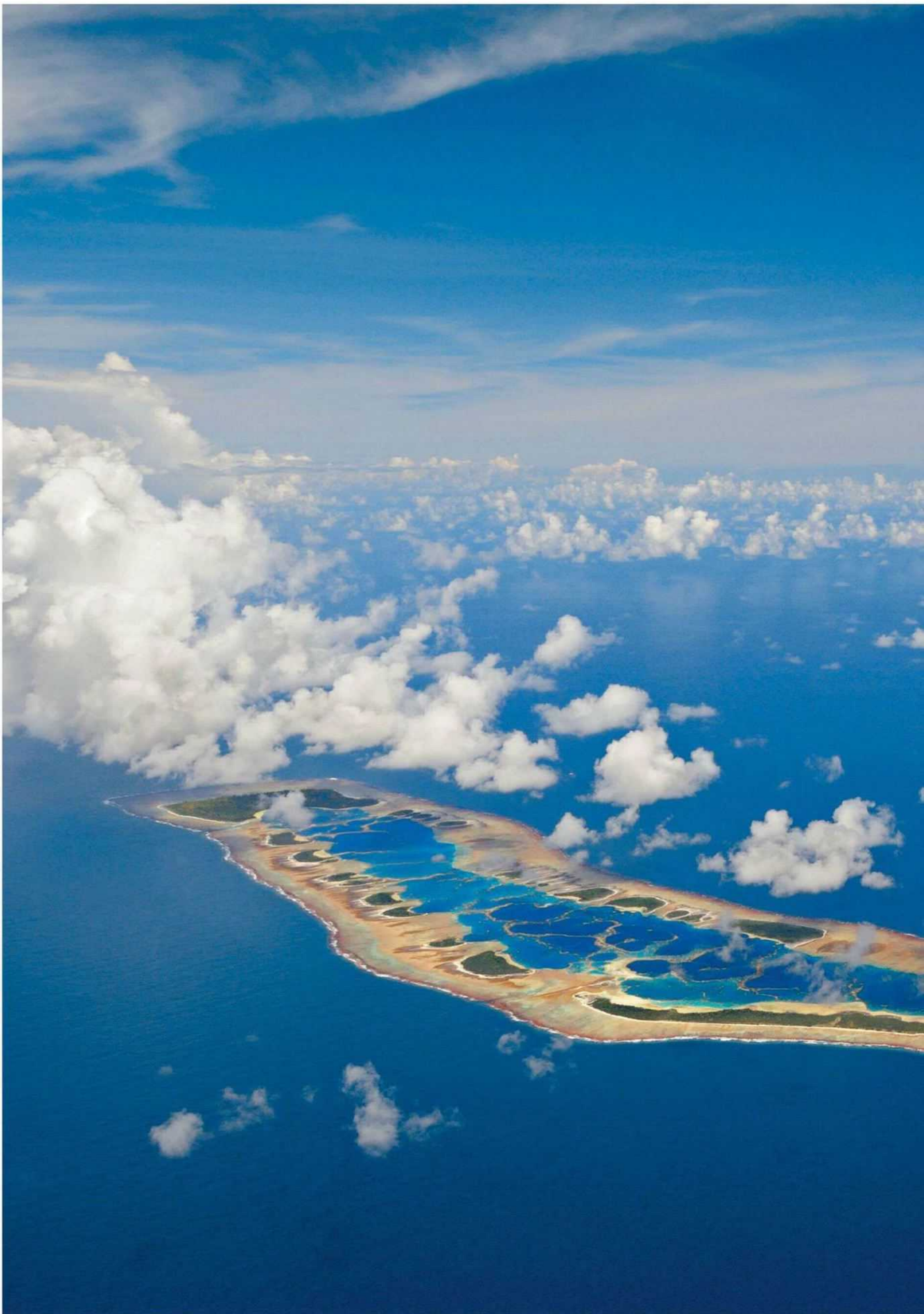




Immigrants fish in the glow of the Roman emperor Hadrian's mausoleum, now called Castel Sant'Angelo, on the banks of the Tiber. In the Eternal City, history is ever present.

ALEX MAJOLI



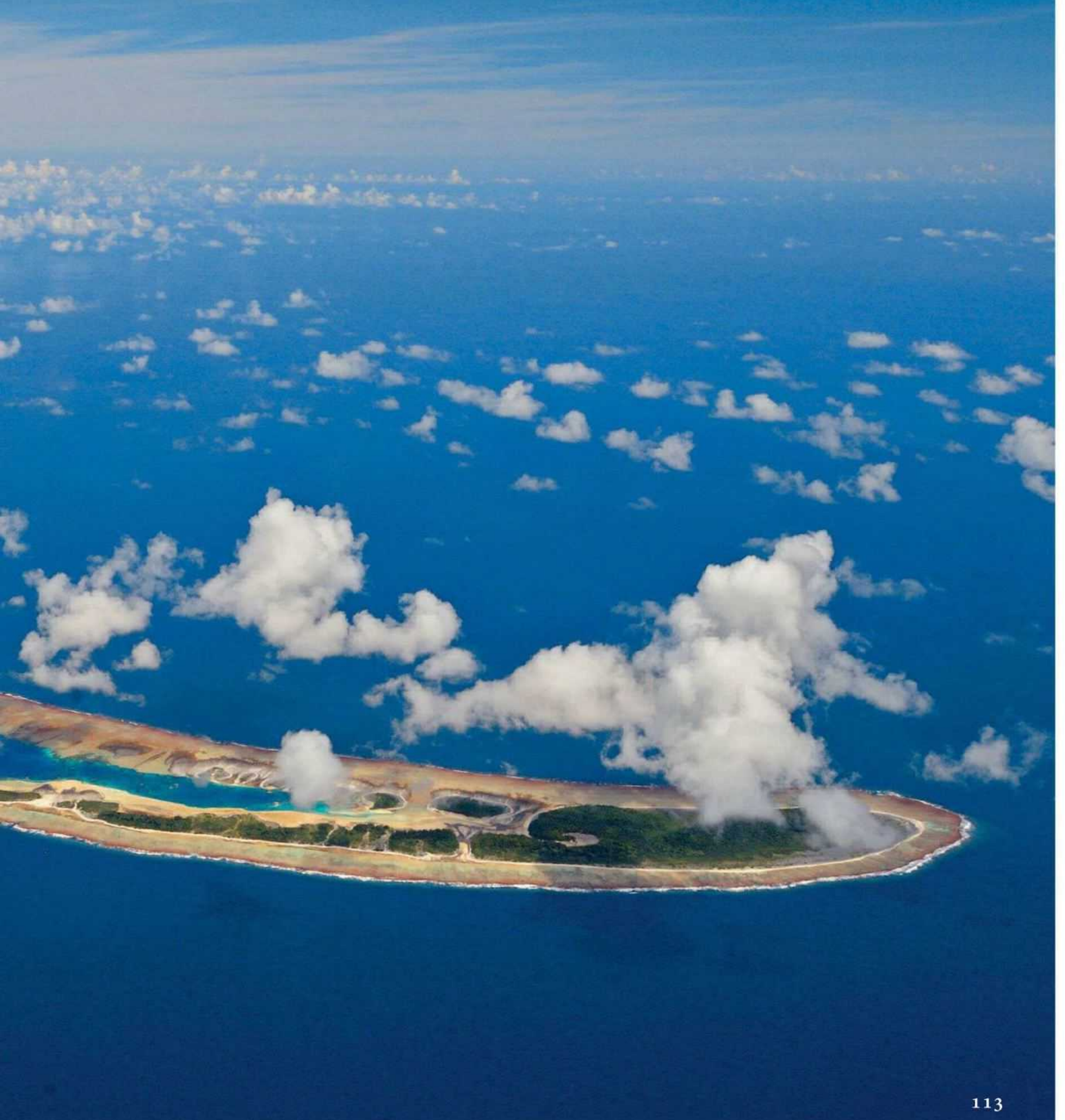




# A WORLD APART

## THE SOUTHERN LINE ISLANDS

An underwater paradise in the remote Pacific Ocean that includes the sea around Caroline Island, seen here, will be protected—thanks in part to National Geographic’s Pristine Seas project.





BY KENNEDY WARNE

PHOTOGRAPHS BY BRIAN SKERRY

**“IF AN ALIEN HAD JUST ONE DAY  
ON EARTH AND WANTED TO SEE  
A CORAL REEF,” SAYS NATIONAL  
GEOGRAPHIC EXPLORER-IN-  
RESIDENCE ENRIC SALA, “I WOULD  
SHOW HIM MILLENNIUM ATOLL.”**

What that alien would see is one part of perhaps the most pristine archipelago in the Pacific: five remote isles named Caroline (commonly called Millennium), Flint, Vostok, Malden, and Starbuck, together known as the southern Line Islands. The waters around these uninhabited specks of land, located 1,500 to 2,100 miles south of Hawaii, are among the last truly wild places in an overexploited ocean.

Now that area will be protected. The Kiribati government recently declared a 12-nautical-mile fishing exclusion zone around each island, part of an effort led by Sala, a marine ecologist, and National Geographic's Pristine Seas project to document and conserve what's left of the planet's least spoiled marine environments. The creation of a southern Line Islands marine preserve is something Sala has been hoping for since he led an expedition to the region in 2009. “These islands help us understand what

Whitemargin unicornfish are among the 325 fish species recorded in the waters of the southern Line Islands. The purpose of the horn is unknown, but it's not for jousting; the fish use sharp spines near their tails to settle territorial disputes.



‘pristine’ means,” he says. “From every perspective—coral density, fish biomass, the number of top predators, the biodiversity—their ecological story is amazing.”

During the 2009 expedition divers spent more than a thousand hours underwater around the five islands. What they found astonished them. On some reefs the corals were so dense they covered 90 percent of the seabed—vastly more than the 5 to 10 percent coral coverage found in the Caribbean.

The scientists were similarly surprised by the health of the crowded coral communities. Across the Pacific, water-temperature spikes caused by El Niño weather events have killed off massive amounts of coral. But the reefs of the southern Line Islands seem to be unaffected by bleaching or disease. “We know this region was hit hard by ocean warming, and we expected to see coral death, but the reefs were





untouched—perfect,” says Sala.

Corals tend to be resilient in places where other elements of the marine ecosystem are flourishing too. In parts of the lagoon at Millennium, densities of giant clams reach up to four per square foot—an almost unheard-of abundance for creatures highly sought for their meat and shells. “Giant clams have been decimated in most atoll lagoons,” says Sala. “In Millennium lagoon the reefs are paved with clams.”

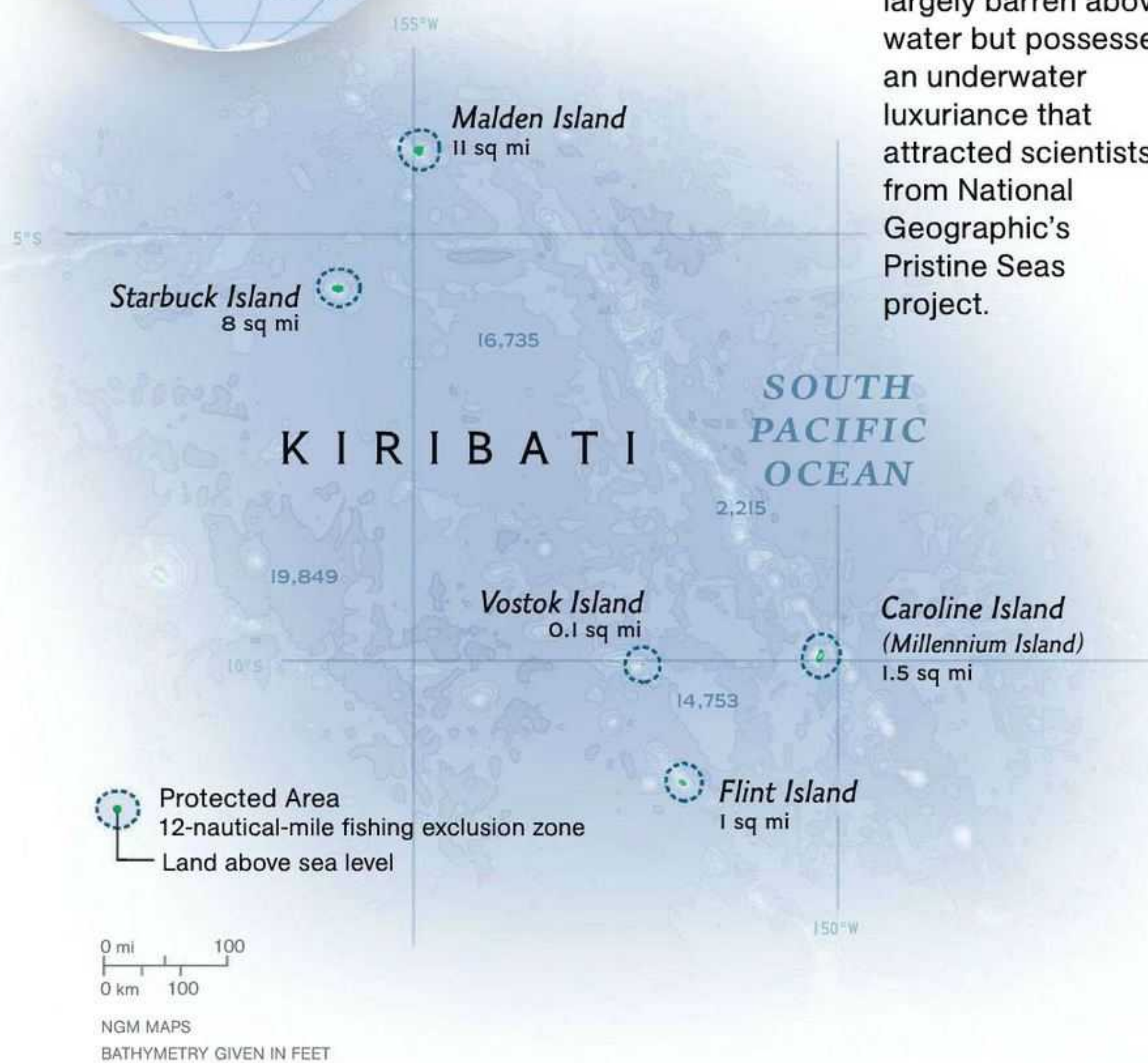
The most common species, *Tridacna maxima*, is better known by a name that seems to contradict itself: the “small giant clam.” These mollusks are a little longer than an American football, but they are dwarfed by individuals from the largest clam species, *Tridacna gigas*, which can exceed four feet in length. At first glance the small giants look like they’re wearing blue, indigo, green, or another shade of lipstick. In fact the color comes from pigment cells

inside their fleshy mantles, which protrude like wavy lips when the shells are open.

The giant filter-feeders act as water purifiers. Microbiologists on the expedition measured bacterial concentrations at every atoll they visited and found Millennium’s clam-filled lagoon to have the lowest count. Bacteria can cause diseases in coral, fish, shellfish, and crustaceans such as crabs. Low concentrations in seawater are an indication of a healthy marine ecosystem.

The southern Line Islands haven’t always enjoyed such splendid isolation. In the 19th and 20th centuries several were exploited for natural resources like guano and coconuts, and in 1957 the British government conducted atmospheric nuclear tests near Malden Island. But none of that human impact is evident underwater. Sala and his team recorded 325 fish species in the southern Line Islands, and estimates of fish biomass (total weight) were some of the





The Line Islands were so named because they straddle the Equator, known to sailors as “the line.” Malden Island is largely barren above water but possesses an underwater luxuriance that attracted scientists from National Geographic’s Pristine Seas project.



highest ever reported from a coral reef. At several locations divers saw endangered Napoleon wrasses, one of the world’s largest reef fish. Also known as the humphead wrasse because of a pronounced bump on the forehead of mature adults, these fish can grow to more than six feet long—large enough to sometimes have their own escort fish, as sharks and large rays do.

The waters around the islands showed the “inverted biomass pyramid” of healthy reefs, in which top predators, as measured by cumulative weight, account for most of the fish—at Malden Island, more than 70 percent. Predator dominance had been previously reported at Kingman Reef, in the northern Line Islands, on an earlier National Geographic expedition. (See “An

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*Kennedy Warne wrote about two Mozambique Channel atolls for the April issue. Brian Skerry photographed bluefin tuna for the March issue.*

Uneasy Eden,” *National Geographic*, July 2008.)

“It’s a seascape of fear,” says photographer Brian Skerry, who was on the expedition. “Everything is either hunting or being hunted.”

On one dive at dusk—what Skerry calls the “shark witching hour”—he found himself hemmed in by gray reef sharks. “There must have been 60 of them,” he says. “I was trying to photograph in a three-sided coral head, and one of them would come in really close. Usually a shark will go away, at least temporarily, if you fend it off, but these guys were doing a quick 360-degree turn and coming right back, and behind that one were five more, and behind them another ten, and you could see them jockeying for position. In 36 years of diving I’ve had some dicey moments with predators, but I’ve never felt physically hunted, as I was here.”

That abundance of predators could easily be lost. Sala reckons it would take just a few





months for a large vessel to strip the reefs of sharks, which are hunted for their fins. The health of the ecosystem could then quickly plummet. Without top predators, midrange predators would likely proliferate, herbivore numbers tumble, and algae overtake the coral.

At Millennium Island divers saw two sharks with stainless steel hooks in their mouths, one of them trailing a length of fishing line. A French sailor moored in the lagoon said he had seen a long-liner working offshore.

Kiribati's move to protect the islands' marine life could help prevent that kind of activity, though enforcement won't be easy. Patrol vessels and surveillance aircraft are expensive in such remote places. Modern technologies, including satellite monitoring and vessel-tracking systems, can alert authorities to the presence of poachers, but stopping them before they inflict ecological damage will be a challenge.

Other threats may be more daunting. Tropical reefs face a climate-change triple whammy: sea-level rise, higher surface temperatures, and ocean acidification. Any one of these can be damaging to reef-building corals; the combined impact could be devastating. Some marine scientists have warned of the imminent and widespread disappearance of tropical reefs.

Rising sea levels also threaten the survival of small island nations. Kiribati's president, Anote Tong, has warned repeatedly that his country, built on coral reefs, could become uninhabitable by 2050, and that its more than 100,000 people might have to abandon their homeland. The preservation of reefs is vital to his people. "The best thing we can do to buy time is to make sure reefs have as much structure as possible—that the ecological machine has all its parts," says Sala. "The more complete a reef is, the more resilient it will be to climate change." □



Blacktip sharks, bluefin trevallies, and twinspot snappers (foreground)—ever watchful for a potential meal—throng a shallow passage into the lagoon of Millennium Island. Top predators like these are a defining feature of the world's healthiest coral reefs.







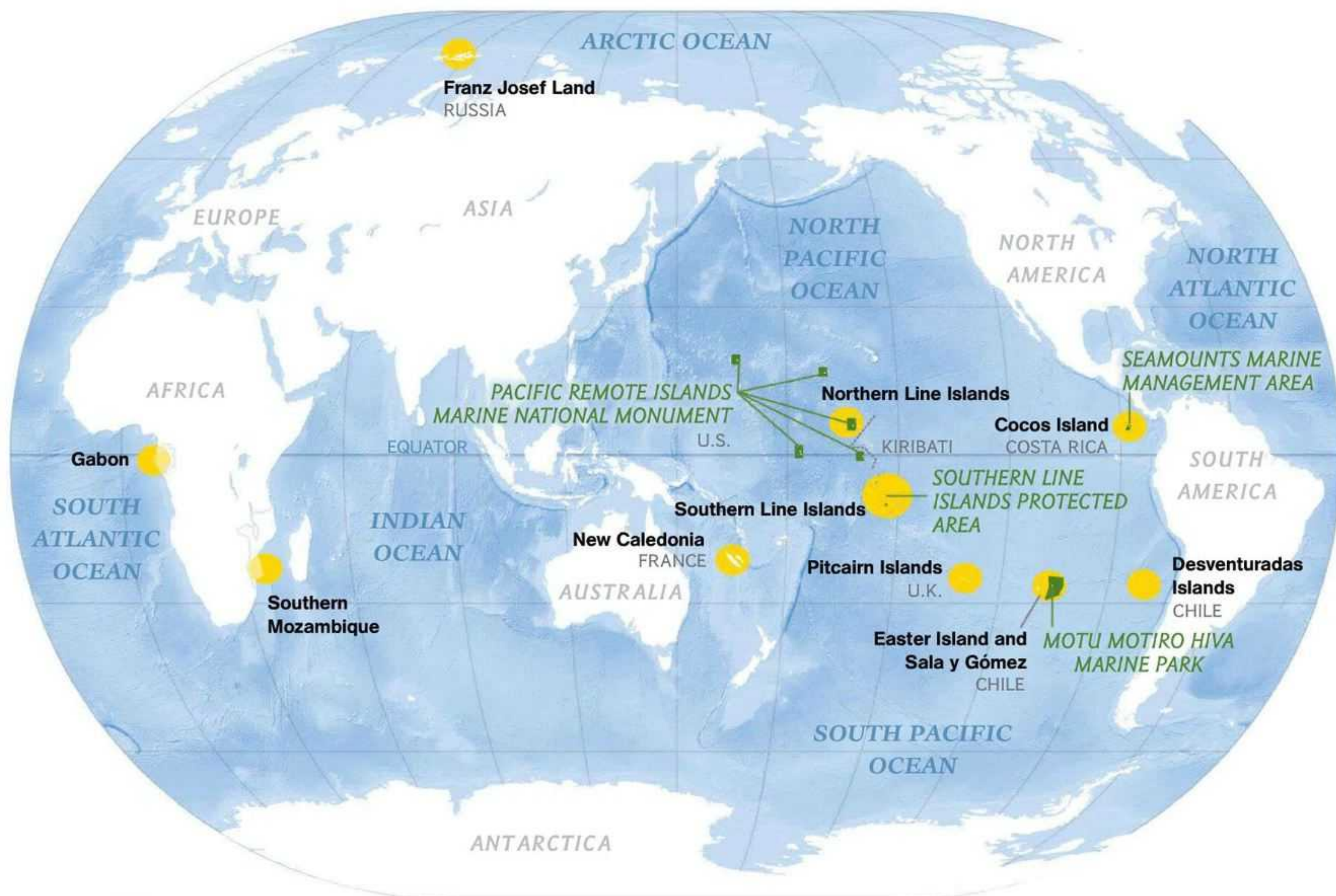




In other places around the world, coral has been decimated by bleaching and disease, but the southern Line Islands' reefs retain their resilience. Scientists believe the key to coral health is intact ecosystems, where all the native species—including planktivores such as the vividly marked Achilles tang (below)—play their part.







 Completed expeditions

## WHERE THE WILD THINGS ARE

National Geographic's Pristine Seas project aims to explore, survey, and help protect the last wild places in the ocean. Such places are living libraries of information about how the various parts of a healthy marine ecosystem fit together. But their number is dwindling as long-distance fishing fleets extend their reach.

The Pristine Seas team, led by Explorer-in-Residence Enric Sala, has conducted research at ten remote locations and has used the findings to influence policy. Working together with governments, foundations, and other conservation groups, Pristine Seas has contributed to the protection of more than 150,000 square miles of ocean, including the Pacific Remote Islands Marine National Monument (U.S.), the Seamounts Marine Management Area (Costa Rica), and the Motu Motiro Hiva Marine Park (Chile).

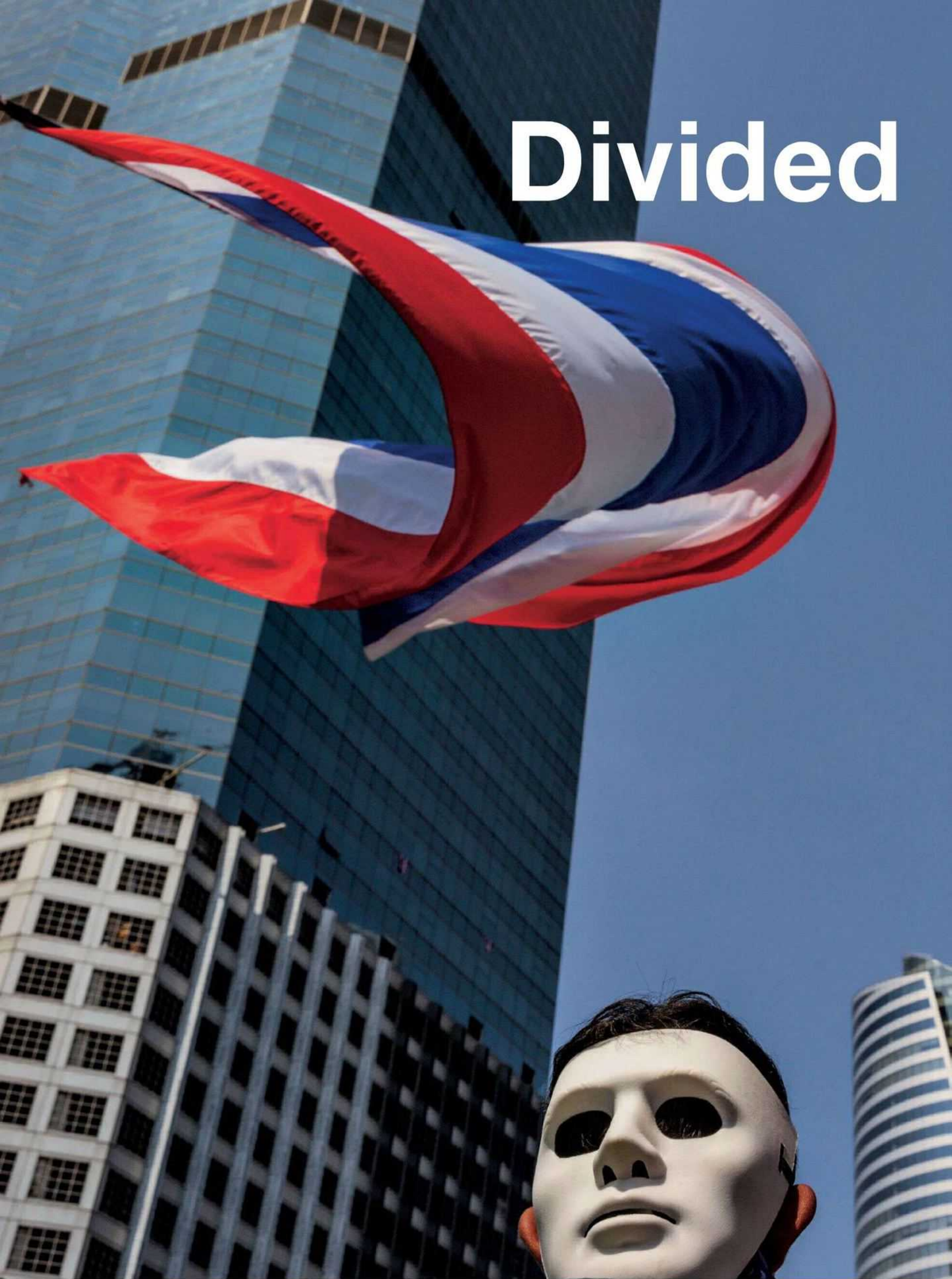
By declaring a no-fishing zone around the southern Line Islands, the island nation of Kiribati has put a check on ocean exploitation there as well. "Diving at the southern Line Islands reveals what the seas once were, in all their richness and wonder," says Sala. "Coming here has reset our entire understanding of what's natural, and has given us a new baseline against which to measure healthy and unhealthy reefs everywhere."

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# Divided





# Kingdom Thailand

Years of political turmoil led to a takeover by the army. What are the roots of the unrest?



Modern Bangkok has become a stage for political theater, from peaceful protests to a military coup.









Many rice farmers in the Chiang Mai area of northern Thailand are “red shirts,” members of a populist movement that has won every national election since 2001. After each victory Bangkok’s traditional elites have reclaimed power by military coup or through court rulings.









Bangkok police below a billboard of Thailand's King Bhumibol Adulyadej come under fire from antigovernment protesters. Four people died and 64 were injured in the February 2014 clash. The twilight of the 86-year-old king's reign is one factor underlying the unrest.









At a mass ordination in northeast Thailand, 89 young men will exchange their white ceremonial cloths for Buddhist monks' robes. Fewer Thai men are entering monastic life, and the monkhood is struggling to remain relevant to more consumer-oriented generations.



**By Seth Mydans**

**Photographs by James Nachtwey**

**T**he allure of money can loosen the grip of tradition, and it was this force that began shaking Thailand's old social order some three decades ago. During the economic boom that began in the 1980s, wealth poured into the country at such a pace that per capita income tripled within one generation. Bangkok, the nation's capital, was transformed into a high-rise metropolis where shopping malls competed for space with Buddhist temples. Country people flocked to the big city for jobs, pulling apart traditional family structures and discovering new ways of seeing the world.

About 10 percent of Thailand's population of 67 million now lives in Bangkok, a figure that rises when the several million migrant workers from rural areas are counted. With paved roads, electricity, motorbikes, and television sets, Thailand's villagers have become some of the most affluent poor people in the world, acquiring the academic label "middle-income peasants."

This rise in well-being has also brought dissatisfaction with the glaring gulfs between rich and poor. As a result Thai society has been undergoing a historic realignment in which the poorer

classes, encouraged by ambitious politicians, have been seeking their share of the prosperity and clout that have always been beyond their reach. An alliance of Thailand's old political institutions—with the palace, the bureaucracy, the judiciary, and the military at their core—has been pushing back, defending the privileges of a hierarchical system that governs both public and private life.

These dynamics came to a dramatic head on May 22, when the military seized power in a coup following seven months of increasing tension. Officials imposed a nighttime curfew and severely restricted free speech and the press. Leaders of the ousted government were seized or went into hiding. Journalists, politicians, and outspoken academics were ordered to surrender.

Among those arrested was Chaturon Chaisang, the ousted education minister. "If anyone thinks that the coup will stop all the conflict and the turmoil, or violence, they would be wrong," he said, before being led away by armed soldiers.

As I write this, just days after the coup, it is impossible to predict where Thailand is heading or even how the situation will stand when this magazine goes to press.

"The underlying forces are ultimately in favor of the demands for distribution of wealth and power," said Chris Baker, a British historian based in Thailand. "But it will only come gradually, and not in straight lines."

The rising underclass forms by far the largest

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*Seth Mydans covered Thailand for the New York Times for more than a decade. James Nachtwey was awarded the Dresden International Peace Prize for a career revealing the human cost of war.*





Icons of different eras meet as Dinsow, a robotic home health aide, attends to a Buddhist monk. Not all changes sweeping Thailand are so benign. Ardent red shirt Sitpipong Sittisuan (top) was shot in the head and lost part of his skull during antigovernment protests in 2010.



political bloc. Its candidates have won every nationwide election since 2001, only to be wrenched from power either by coup or by highly politicized court rulings. A new mood of animosity and intolerance is infecting a culture in which confrontations are typically wished away by indirection, soft words, and that all-purpose Thai smile.

During the first months of this year, in a campaign called Shut Down Bangkok, tens of thousands of protesters paralyzed parts of the city, blocking intersections and filling the air with the earsplitting screech of whistles. It was an extraordinary spectacle of what were, in effect, antidemocracy protests. In the run-up to national

is not antidemocratic, just that it has a different definition of democracy. “You can’t say that American or British is the only strategy for democracy,” Danuch Tanterdtid, the yellow-shirt owner of a foreign language and computer school told me. “Democracy is a culture and a way of thinking. In Thailand we had the king before we had democracy. It takes time to adjust.”

King Bhumibol Adulyadej has long occupied a place at the core of Thailand’s sense of identity and nationhood. Now 86, he has been on the throne since 1946, longer than most Thais have been alive. For many it is impossible to imagine their nation without him. King Bhumibol has used his moral authority to defuse serious crises

## **“We don’t have democracy, and we know we are going to have to fight for it.”** —*Thai protester*

elections on February 2, these protesters kept candidates from registering and prevented the delivery of ballot boxes. On election day they physically blocked polling stations, tussling with people who tried to breach their barricades to vote. So many polling stations were forced to close that the Constitutional Court controversially annulled the vote, leaving the country in a dangerous and acrimonious limbo.

The coup came after Yingluck Shinawatra, the country’s democratically elected prime minister, was forced from office by the same Constitutional Court, which found her guilty of abuse of power. It followed months of rumors of military action in a country whose democratic system has been battered by some 20 military coups or attempted coups since 1932, the year Thailand became a constitutional monarchy.

Most baldly put, Thailand’s disenfranchised citizens, commonly known as the “red shirts,” want elections because they know they will win. The other side, which initially coalesced as the “yellow shirts,” has sought to change the electoral system because it knows it does not have the votes to hold on to power.

The anti-election movement insists that it

in the past, and many Thais hoped he would act again as the current confrontations grew. But in recent years the ailing king has faded from the scene, a silent presence amid the upheavals. A constitutional monarch, the king has no direct political power, but he can wield considerable influence. It’s unlikely that any heir can inherit the veneration and moral stature that have built up around King Bhumibol.

At the same time, under the forces of globalization and modernity, Thailand has been growing away from the structured world represented by the monarchy. Though nearly 95 percent of Thais identify themselves as Buddhist, form has taken precedence over faith for many, and religion is losing its central place in their lives. The monkhood has been tainted by scandals and consumerism. Fewer young men are shaving their heads and entering the monkhood for a period of weeks or months—once a common rite of passage.

The dominant political figure in Thailand today is a man who is not even in the country. Thaksin Shinawatra was ousted as prime minister in a coup in 2006 while traveling abroad but continues to command the biggest electoral constituency in the country. The most recent election, in



2011, was won by his youngest sister, Yingluck, whom he promoted unashamedly as his “clone.” The campaign to shut down Bangkok followed an attempt by her government to pass an amnesty bill with a last-minute provision that would have freed Thaksin from a conviction for corruption and allowed him to return home.

It was the genius of Thaksin, a telecommunications billionaire from outside the entrenched oligarchies, to recognize the potential influence of the country’s underrepresented underclass, wooing them and winning their fealty with policies like low-cost health care and financial support. A new electoral majority rose to flex its power and threaten the primacy of the Bangkok-based elite. After winning the national election in 2001, Thaksin was reelected with a huge majority in 2005.

But despite his democratic election, Thaksin was no democrat, expanding his power by neutering independent agencies that were intended to check executive power, squeezing press freedoms, and using his office to enrich himself.

In the take-no-prisoners manner that had entranced some Thais, he reanimated a long-simmering Malay Muslim insurgency in the southernmost provinces with harsh, militarized policies that included massacres of civilians. In the past decade some 6,000 people have been killed in a low-intensity war of assassinations, ambushes, and bombings that draw only passing attention in distant, largely Buddhist Bangkok.

The coup in 2006 failed to erase Thaksin’s influence, and when the generals handed power back to the people in an election, his party won again. As the courts and military acted to oust one pro-Thaksin government after another, Thailand fell into a pattern of alternating, sporadically violent yellow- and red-shirt protests.

In 2010 tens of thousands of red shirts took over the core of Bangkok’s central shopping district for two months. “What brought me out there was a lack of equality and fairness,” a farmer from the northeast told me. “We don’t have democracy, and we know we are going to have to fight for it. Nobody is going to give it to us.” After attempts at negotiation failed, the



military moved in and broke up the protest in days of gunfire, mayhem, and arson. More than 90 people, mostly civilians, were killed. There have been more deaths since then, as violence has permeated the political struggle.

Neither side is willing to concede defeat, and the words “separatism” and “civil war” can be heard from people who offer extreme scenarios. A backlash against the latest coup began soon after the generals seized power. Given Thailand’s recent electoral history, the chance of a fair vote in which the losers accept defeat appears to be a long shot. The divisions are so deep, and the opposing sides so entrenched, that no scenario seems likely to bring calm anytime soon. □









Fashion designers Vatit Virashpanth and Itthi Metanee fit a model in one of their latest silk gowns. High society in Bangkok is flourishing in the wake of an economic boom that started in the 1980s, but widening income inequality leaves most Thais struggling.









Not far from the high-rise hotels and malls of the touristy Sukhumvit area, poor Thais squeeze into makeshift homes in Bangkok's Khlong Toei slum. This couple and their 15-year-old daughter (sleeping) make a living picking through garbage for recyclables.









Sweat and hope pervade Thai boxing gyms, where young men like Phetphanom Meenayothin seek to fight their way out of poverty by attaining stardom in the popular national sport. Phetphanom, 22, here training in Bangkok, is from a family of rubber-tree tappers in the south.









Muslim girls study at a publicly financed school for orphans and needy children in Pattani Province, on the southern tip of Thailand. Populated chiefly by ethnic Malays and once a sultanate, Pattani is among the nation's least developed regions.









Malay Muslim insurgents killed in a firefight with the Thai Army lie outside a Pattani mosque. Ethnic Malays predominate in the three southernmost provinces, annexed in 1909 by what was then Siam. Some 6,000 have died since 2004 in an ongoing bid for autonomy.









This man reveres King Bhumibol—currently the world's longest serving monarch—his youthful picture held close on a street in the northeastern province of Loei. Long unassailable, the monarchy faces new scrutiny in an era of growing political divisions in Thailand.





## Deer Girl

“A belle of Mombasa with her pet deer”—actually a juvenile antelope—posed for this photograph in the March 1909 *National Geographic*. “Antelope steak is a favorite dish in this region,” notes the photo’s caption, “but this particular pet is a treasured favorite, safe from the hunter’s rifle.” The young Kenyan woman here, the caption goes on, “paints circles on her cheeks and dyes her hands purple, and is a recognized model of feminine stylishness.”

—Margaret G. Zackowitz

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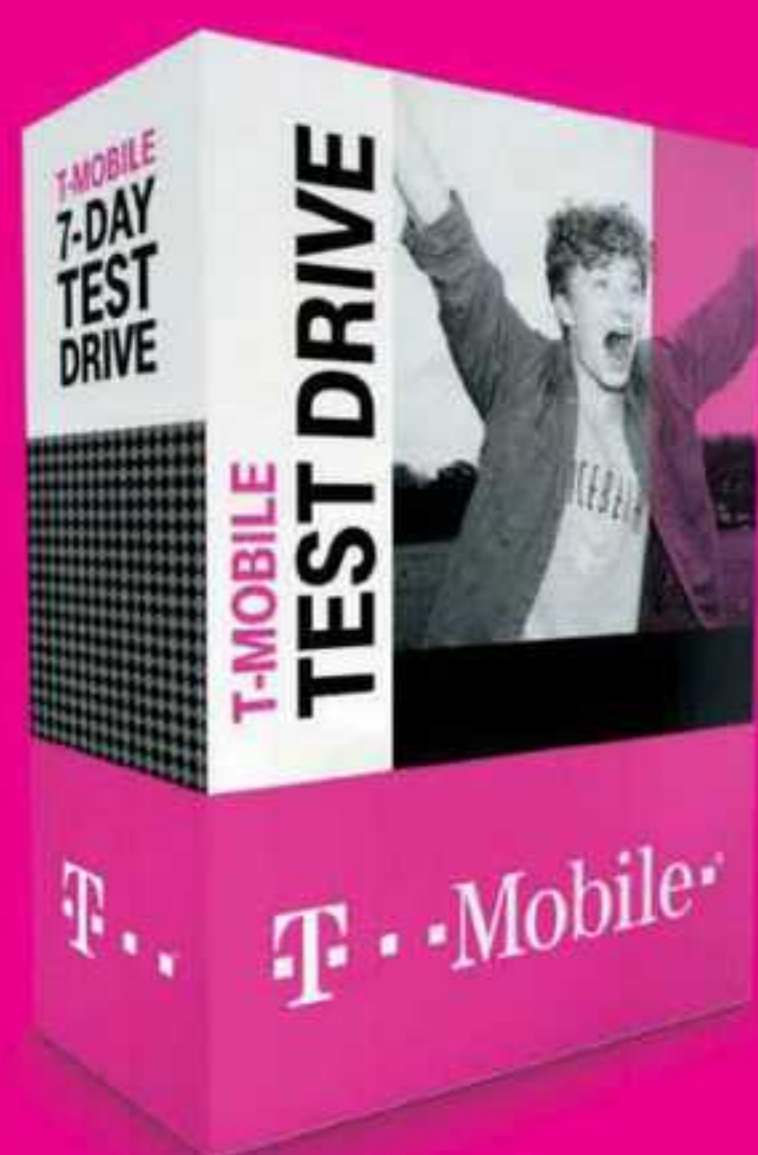
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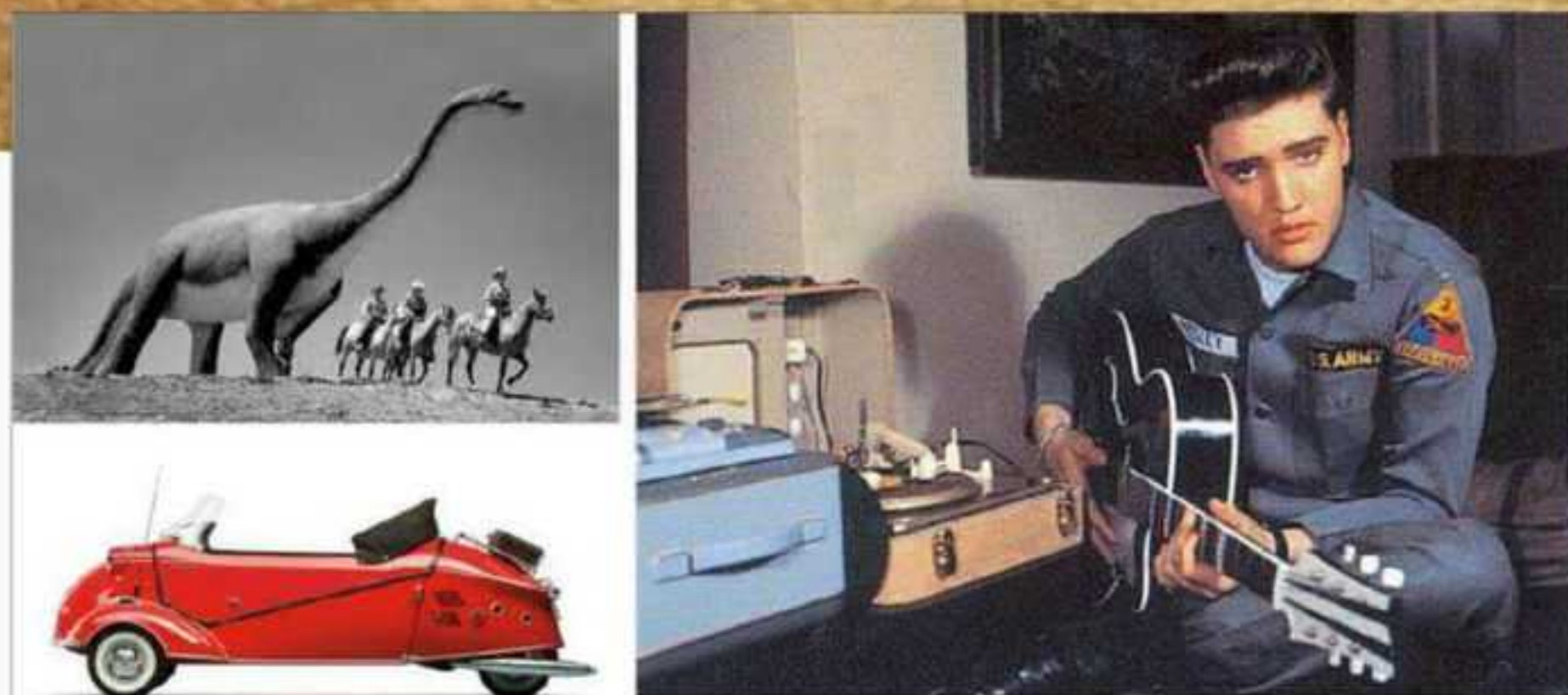
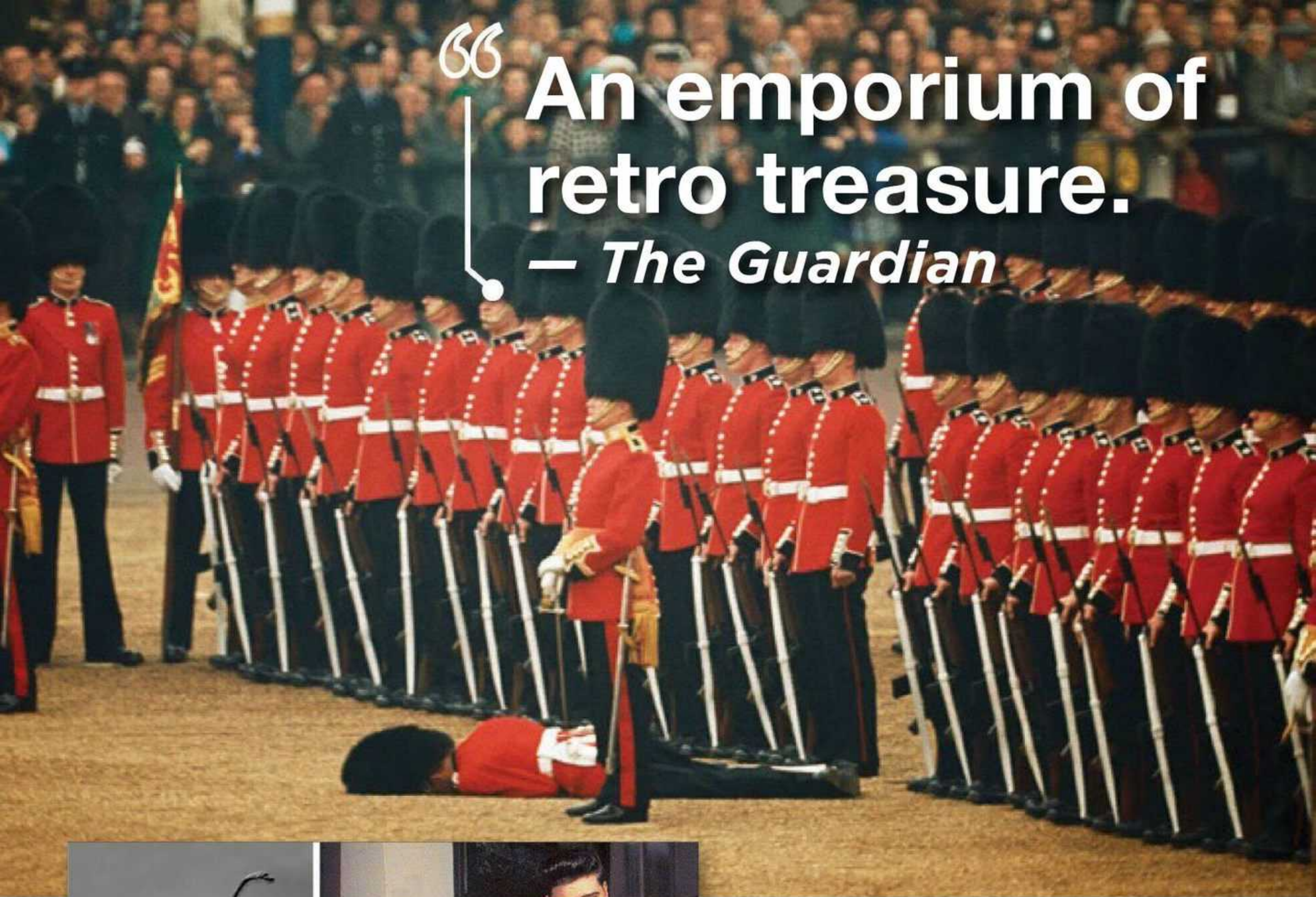
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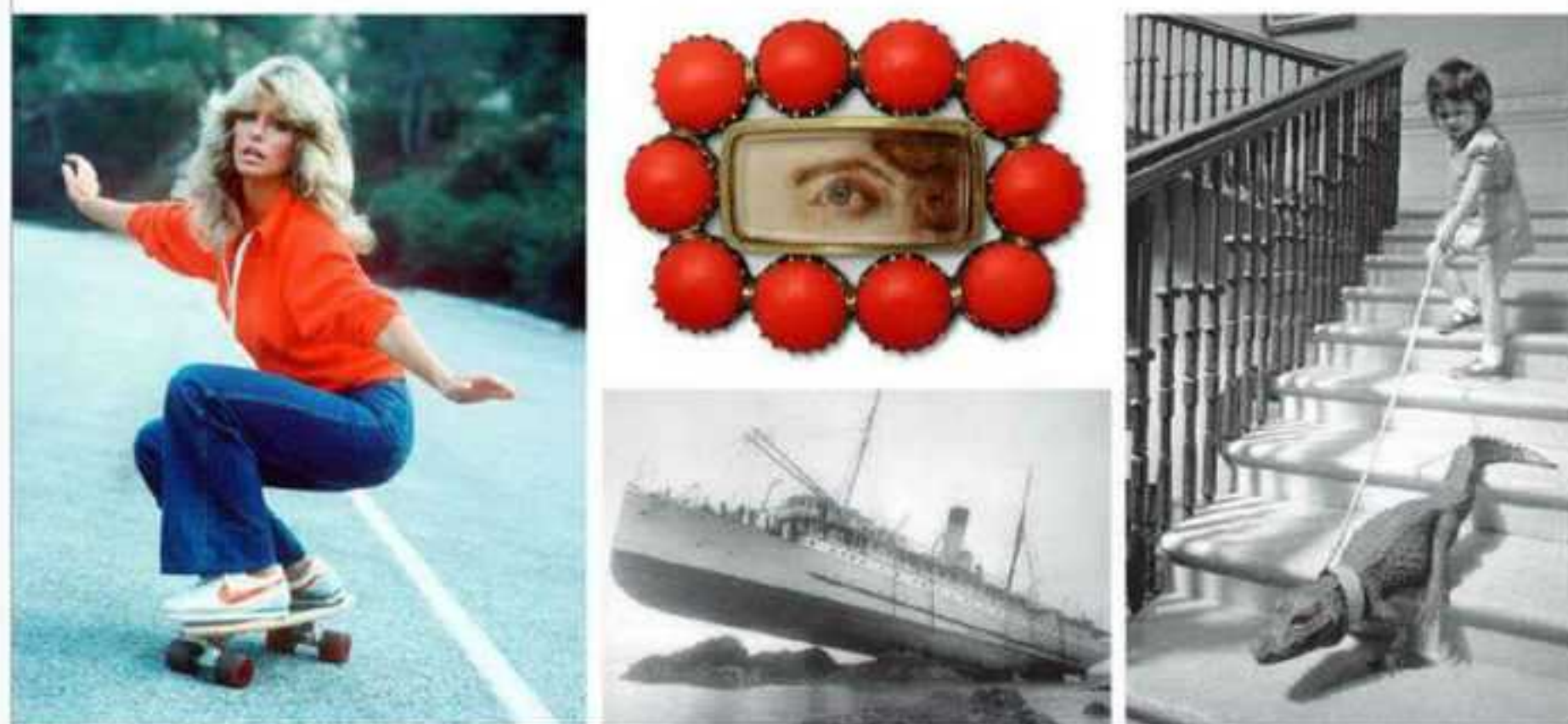
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# Retronaut

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